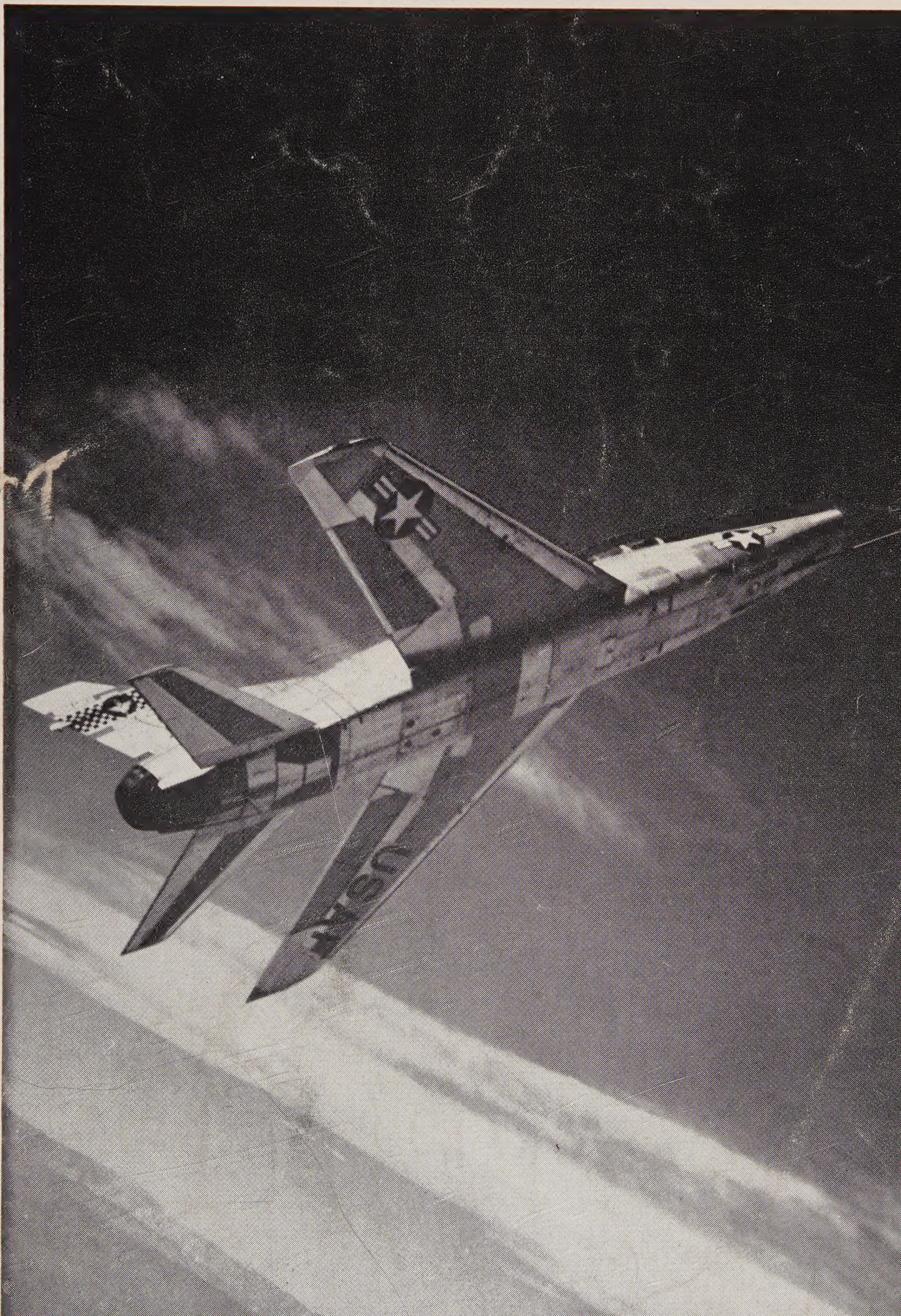
Skyways

Flight Operations
•
Engineering
•
Management



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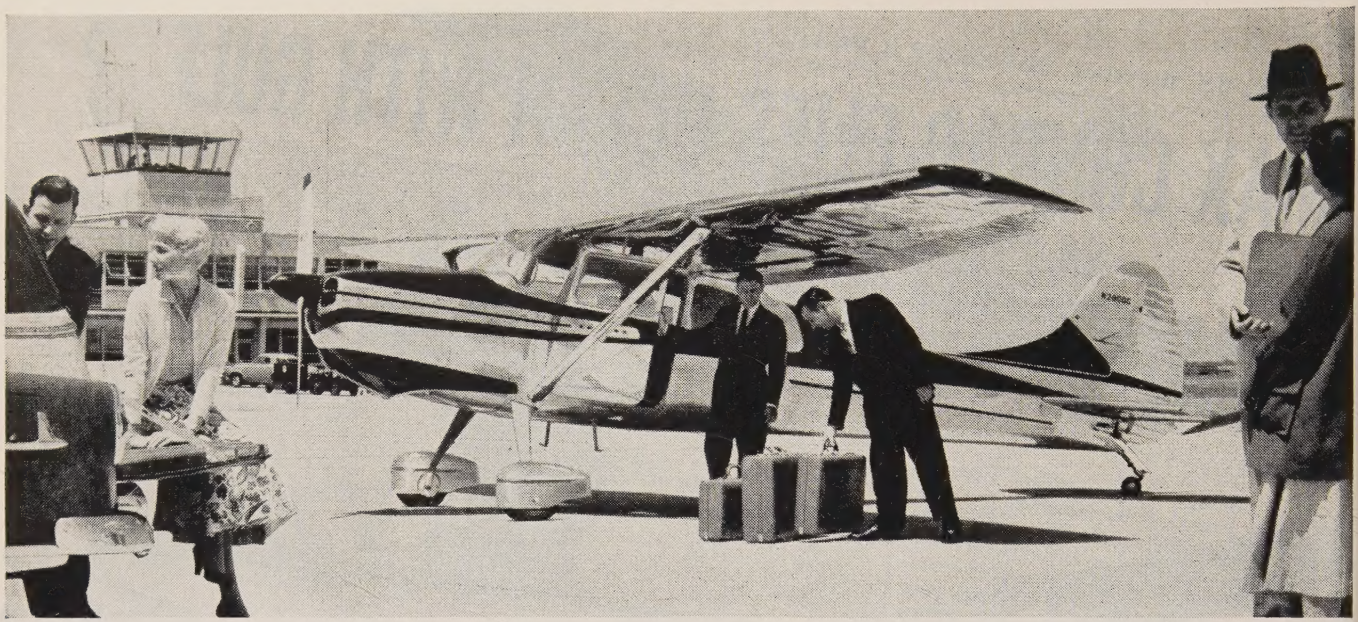

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Count them as your Cessna dealer names them . . . more than 100 extra-value features on the 1955 Cessna 170 that you won't find on any other low-priced airplane! Big features, little features that add up to greater comfort, smoother operation, greater dependability and safety. Yet this all-metal, extra roomy, 6-cylinder airplane is priced just above the lowest. With all its extra features—it's only $8,295. See it at your Cessna dealer's now. (He's listed in the yellow pages of your phone book.) For more information, write CESSNA AIRCRAFT CO., DEPT. S-2, WICHITA, KAN.

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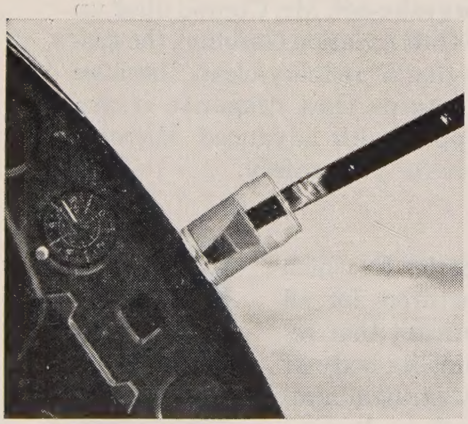
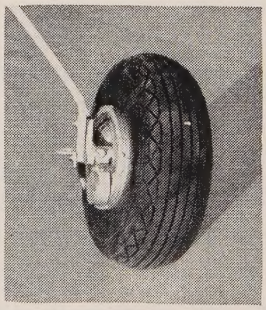
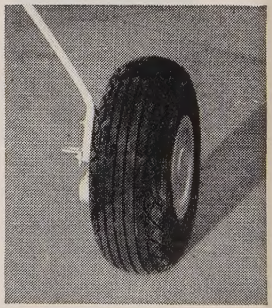


Even in a 60-degree bank, the glass of water placed atop the Cessna instrument panel doesn't vibrate or slide off. Reasons: Cessna's smooth, dependable 6-cylinder engine; Cessna's stable high-wing design; Cessna needle-point control bearings for quick, smooth control handling. Features that add up to smooth, comfortable, effortless flying.

Easiest, Safest Take-offs, Landings

New Positive-steering tail wheel and famous Goodyear castering wheels (opt. now for only $245) let you land, taxi and turn the 170 more easily, safely than any airplane in its class. Wheels pivot to parallel runway even when gusts alter direction of airplane. Makes cross-wind strips easy to use.





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Cessna 170 offers thick foam rubber seats, *widest* rear seat in its field by 8 inches! PLUS other standard equipment extras: Two yard-wide doors offer access to front and rear seats from *either* side of cabin . . . 6-outlet heating-ventilating system—120-lb. luggage space—*all* seats adjustable—longest, widest cabin, most leg room in its field.

CESSNA 170 180 195 310 THE COMPLETE AIR FLEET FOR EVERY BUSINESS NEED!

FEBRUARY, 1955

Skyways

Flight Operations • Engineering • Management

COVER: North American F-100 Super Sabre

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industry notes . . .

■ The Lycoming Division of Avco Manufacturing Corporation has begun testing the first production model of the R-1300, a 900-hp (take-off) engine which powers the Sikorsky H-19 helicopter and the North American T-28-A trainer. The R-1300 is manufactured by Lycoming under license from Curtiss-Wright.

■ The Board of Directors of Fairchild Engine and Airplane Corporation has appropriated more than a million dollars of company funds for an accelerated program of boundary layer control applications to transport aircraft.

■ Fuel contracts are making news this month. Socony-Vacuum Oil Company recently signed a contract with Trans-Canada Air Lines which calls for delivery of more than 2,500,000 gallons of jet fuel (JP-4) in 1955 and more than 3,000,000 gallons a year in 1956 and 1957. This fuel will put the first of Trans-Canada's 22 turboprop *Viscounts* into service between New York and Montreal. Shell Oil was awarded a four year contract by Capital Airlines to supply kerosene for its fleet of 60 *Viscounts.* Shell also is a large supplier to Capital of aviation gasoline for its piston-type aircraft. Pratt & Whitney awarded Shell a contract making it the exclusive supplier of piston engine oil (AeroShell Oil 100). Shell also will supply 50% of P&W's increased jet fuel needs.

■ Bell Aircraft has announced that its 1954 commercial helicopter sales climbed 20% above that of the previous year, and that total billing for commercial craft and spare parts rose 32% for the same period. Foreign sales accounted for nearly 70% of the business.

■ Link aviation has received a contract from the Air Materiel Command to build a prototype simulator for the Cessna T-37A jet trainer. Link expects soon to deliver a simulator for the Air Force supersonic F-102.

■ Curtiss-Wright Corporation announced the development of the first rocket engine in the U.S. that can be throttled up or down at will. No engine details have been released.

■ Capital Airlines' turboprop *Viscounts* will be equipped with Bendix PB-10A automatic pilots with "flight path control," designed and built by Eclipse-Pioneer division. The *Viscounts* also will carry a second Flux Gate compass system. First deliveries of the automatic precision equipment already have been made to England.

■ Lockheed Aircraft has received a new order for 46 P2V-7 *Neptunes* from the Navy. This order extends production of the aircraft into late 1956.

■ The Port of New York Authority has approved construction of four 220,000-gallon aviation fuel storage tanks at New York International Airport. The new tanks will augment the existing 28 tanks with a total capacity of 4,000,000 gallons located in the fuel storage area in the northwest section of the airport. Eight million gallons of fuel are used at the airport each month.

■ Republic Aviation has begun deliveries to the Air Force of its RF-84F photo-reconnaissance fighter for making combat pictures. First unit to get the *Thunderflash* is the 363rd Tactical Reconnaissance Wing of the Tactical Air Command at Shaw Air Force Base, Sumter, S.C.

■ Armstrong Siddeley's *Sapphire* 7 jet engine recently was type-tested at 10,200 lbs thrust. This is the highest thrust yet announced for any British type-tested engine and was recorded without the use of injection, afterburner or other thrust-boosting devices. U.S. license for this engine was acquired by Curtiss-Wright in 1950 and is known as the J65.

■ Fairchild Engine Division has been awarded a contract for the development of a new, small-size, lightweight gas turbine engine for drones and pilotless aircraft. The contract has been labeled a competitive development type which indicates that a similar order has been assigned to General Electric Company's Small Engine Department, Aircraft Gas Turbine Division.

now hear this . . .

PERSONNEL

Dr. Jerome C. Hunsaker of MIT, Boston, has been re-appointed to membership on the National Advisory Committee for Aeronautics. **Frederick C. Crawford,** Chairman of the Board of Thompson Products, Cleveland, was named to replace Ronald M. Hazen on NACA.

Stanley Hiller, Jr., president of Hiller Helicopters, has been elected 1955 chairman of the Helicopter Council, AIA.

Frank C. Nash, former Assistant Secretary of Defense, Washington, **Robert B. Watts** of La Jolla, California and **Allen D. Marshall,** secretary and vice president of General Dynamics Corporation, have been elected to General Dynamics board of directors.

Walter Tydon, chief engineer of Fairchild Aircraft, has been re-elected Air Cargo Advisory Committee chairman for 1955. **L. R. Hackney,** Fairchild's assistant general manager, has been named ACAC's chairman of the Airframe Task committee, and **George W. Westphal,** preliminary design engineer for Fairchild, and **R. W. Johnson,** customer relations representative, were named to serve as members of the 1955 Committee.

J. S. Parker recently was appointed General Manager of the General Electric Company's Aircraft Gas Turbine Division.

Sir Alwyn Crow, England's outstanding rocket expert, has been retained by Aerojet-General Corporation as consultant.

Edward E. DeParma of Sperry Gyroscope Company recently was named vice president for industrial relations. **George A. Richroath** was named vice president and works manager, and **Arthur R. Weckel** was appointed vice president and general sales manager of Sperry. **Frank Conace** was named sales manager of Sperry's new Aeronautical Equipment Division; **Michael Curatolo** was named manufacturing superintendent, and **Thomas Hannah,** manufacturing planning superintendent. **Anthony Ruggiero** was named quality control superintendent.

Everett M. Patterson, William O. Boschen and **H. Hawley Myers** have been elected vice presidents of Avien Inc.

R. A. Stranahan, Jr., recently was named to succeed his father as president of the Champion Spark Plug Co.

Reagan C. Stunkel, vice president in charge of operations of Hydro-Aire, Inc., has been named to head Hydro-Aire's newly formed Electronics Division. **Robert J. Trivison** was appointed works manager.

Clark Hickerson has been appointed manager of customer service for Ryan Aeronautical Co.

Francis H. Langenfeld was named supervisor of functional fluid sales for Monsanto Chemical Company's Organic Chemicals Division.

Herbert Kunzel has been elected executive vice president of Solar Aircraft Company. **Donald W. Angell** has joined Solar's Dayton office as field engineer, and **William D. Wood** has been named sales manager of Solar's Washington (D.C.) office. **Robert G. Kitson** has been appointed sales engineer in New York.

Vernon A. Johnson recently was appointed manager of Lockheed Aircraft's Washington (D.C.) office. Mr. Johnson replaces **John L. Hill** who has returned to Lockheed's California headquarters to become manager of the Military Sales.

Ted Grohs has joined the Aircraft Engineering Division of Lear, Inc., as special assistant to Gordon Israel, chief engineer, and William P. Lear, Board Chairman and Director of Research and Development of Lear, Inc.

HONORS

Jerome Lederer, managing director of Flight Safety Foundation, Inc., was awarded a bronze medal at the Royal Netherlands Aero-Club for his valuable contributions to flight safety.

COMPANIES

Bell Aircraft Corporation has acquired full ownership of Hydraulic Research and Manufacturing Co., Burbank.

Sperry Gyroscope Company has formed a new Aeronautical Equipment Division at its Great Neck main plant. **Herb C. Bostwick** has been named manager of the new division.

Pester's Propeller Service, Inc. has moved from Mineola, N.Y., to larger quarters in a new building at 99 State Street, Westbury, N.Y.

Minneapolis-Honeywell's Aeronautical Division has established a new aircraft engineering center in Los Angeles. **John V. Sigford** has been named manager of the center.

AERO CALENDAR

Jan. 31-Feb. 4—American Institute of Electrical Engineers winter meeting, Hotel Statler, New York.

Feb. 20-22—Fourth Annual Texas Agricultural Aviation Conference, A&M College, College Station, Texas.

Feb. 26-27—Ninth Annual Pacific Coast Mid-Winter Soaring Championship, Torrey Pines Glider Port, San Diego, Calif.

Mar. 11—IAS Nat'l Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.

Mar. 20-23—Aero Medical Association Annual Meeting, Hotel Statler, Washington.

Apr. 5—International Air Transport Association technical conference, San Juan.

Apr. 5-7—Radio Technical Commission for Aeronautics spring assembly and joint meeting with Institute of Radio Engineers, Los Angeles.

Apr. 16-20—American Association of Airport Executives Annual Meeting and Convention, El Conquistador Hotel, Tucson, Arizona.

May 4-6—Fourth International Aviation Trade Show, 69th Regiment Armory, New York.

June 21-24—Aviation Distributors and Manufacturers Association 13th Mid-Year Meeting, Breezy Point Lodge, Brainerd, Minn.

BEECHCRAFT "SUPER 18"

by Herb Fisher

Chief, Aviation Development, Port of New York Authority

The problem tossed into the laps of Beech Aircraft engineers was simply this: Improve the over-all performance of the D18S, an aircraft under almost continuous improvement since its first flight in 1937, without making any radical changes in its basic configuration.

The end result of this difficult assignment is the "Super 18" Beechcraft, or E18S, which provides a new level of maximum efficiency in performance and better serviceability to prospective users in the expanding utility aircraft market.

This latest evolution of the Twin-Beech, a transport used by more business operators than any other twin-engine aircraft, carries a 550-lb increase in gross weight, but despite that higher gross its cruising speed has been upped to 214 mph and its range has been extended from about 1,230 miles to 1,455 miles. Other dividends of the modification include increases in single-engine rate of climb and ceiling, better take-off and climb, and a greater degree of comfort in pilot and passenger compartments.

An indication of how far Beech has progressed in the evolution of this reliable twin is shown in the following comparison. The first Twin-Beech, the 18A, was an 8-place aircraft with a maximum gross weight of 7200 lbs. It was equipped with Wright R-760-E2 engines which developed 325 hp at take-off. The "Super 18" has a design gross of 9300 lbs and is powered by two P&W R-985-AN-14B engines, each rated at 450 bhp for take-off. Seating arrangements are flexible and a matter of customer preferance, but the average number of chairs is six.

The E18S which I had the opportunity to fly was the No. 6 production airplane, which had just been delivered to W. E. Richards, vice president of Atlantic Aviation Corporation at Teterboro, N.J., air terminal. Richards, who had been conducting a tight demonstration schedule with the new sharp-nosed Twin, took time out to give me a stem-to-stern run-down on the airplane. His pilot-sales manager, Gene Larimer, was my host for the flight phase of my visit.

It is pretty obvious that the Beech engineering staff prepared and followed a carefully formulated plan in its program of re-designing the Twin to meet the needs of prospective executive owners. Their close attention to details in the over-all job is everywhere apparent, and executive users are going to find that in passenger and pilot comfort the "Super 18" will be hard to beat.

For example, it is easier to get in and out of the E18S because the cabin door is larger and has been moved back one section. The door drops down to provide a stairway, eliminating the need for a separate ladder. A spacious luggage rack is placed conveniently at the passengers right as he enters the cabin.

Usable cabin length between bulkhead 5 forward and bulkhead 9 at the rear is 10 feet 5 inches and the width is 52 inches. Maximum height of the cabin is slightly over 66 inches. This means a much roomier cabin and one which makes for greater flexibility in interior arrangements. The cabin can be arranged to accommodate up to nine persons. Four large windows on each side of the cabin serve to increase passenger visibility. Illumination for the passenger area comes from indirect, flush ceiling lights. And there is an adjustable reading light for each chair. Another important item in the comfort and convenience list is improved soundproofing.

The seating arrangement for passengers has been made easier by the elimination of the old-type, hinged door which swung into the cabin. In its place on the "Super 18" is an accordion-type double door which can be operated with one finger.

You step forward through that door into a cockpit which instantly reflects Beech's concern for pilot comfort and efficiency. Through redesign of the E18S nose and windshield, the height of the cockpit has been increased by 7 inches. That extra head room is mighty important, especially to pilots who sit tall in the saddle.

The instrument panel is the basic SAE configuration, and everything which could be taken off the cockpit ceiling has been removed and relocated for greater convenience and efficiency. The left sub-panel on the pilot's side has a neatly arranged group which includes volt-ammeters, accessory circuit breaker switches, generator and battery switches, landing-light switches, Grimes rotating-beacon switch, starter, primer and booster switches, navigation light, windshield wiper and engine selector switches. On the right sub-panel are propeller anti-icer control, accessory and lighting circuit breakers, ignition switches, cabin dome light switch, cabin sign, and cabin temperature control. Ignition switches and the propeller anti-icer are placed at the extreme left side of the right sub-panel where the pilot can reach them without stretching. The new streamlined windshield provides excellent forward visibility and there are side windows and a window in the upper fuselage curve on each side of the cockpit.

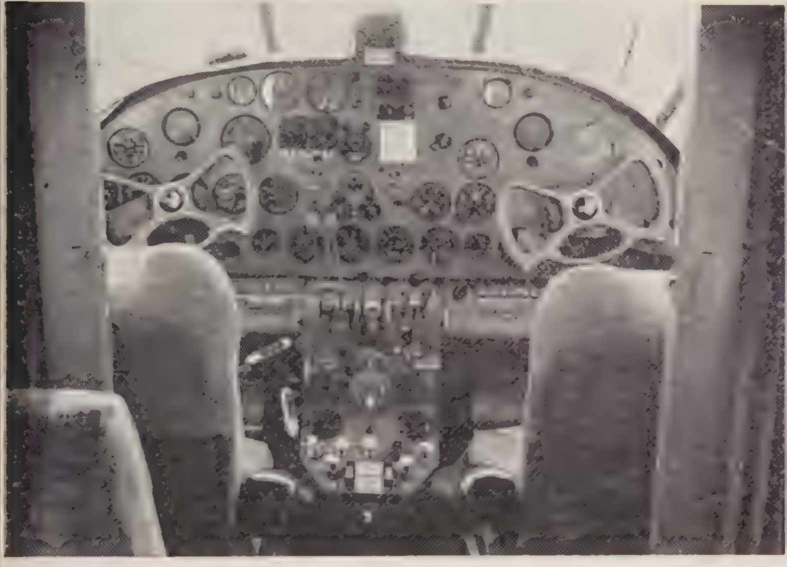
Our first take-off from Teterboro was made with 2,075 rpm and 30.5 inches to 10,000 ft. That gave us a climbing rate of a bit over 1,000 feet on about 310 hp. With full gross of 9300 lbs, the "Super 18" will climb out at take-off at 1,350 fpm, and when the gross drops to 8,750 lbs the rate steps up to 1,490 fpm.

The single-engine rate of climb also is good. At maximum gross, the E18S has a sea-level climb rate of 320 fpm. At 5,000 ft its rate is 200 fpm. Absolute single-engine ceiling at the 9300-lb gross is 8700 ft, but the "Super 18" will maintain altitude up to 10,000 ft.

The optimum cruising speed of the E18S is 215 mph at 10,000 ft at 66.7% of power, or 300 hp per engine, so we climbed up there to run a check on those figures. My notes show that at that altitude, at 2,000 rpm and 27 inches (300 hp per engine), the E18S indicated 178 mph and trued out close to 210 mph.

The aircraft handles well in both power-on and power-off stalls, but I personally prefer a more pronounced natural warning in all stall configurations than I got with the E18S. The airplane can be held under control throughout the power-on stall but un- (*Continued on page* 28)

THIS NEW *version of the standard Beechcraft 18, known as the "Super 18," includes a longer nose section, streamlined windshield with better visibility, longer tail wheel strut, stair-door, extended wing section with improved tip design, and a roomier interior*



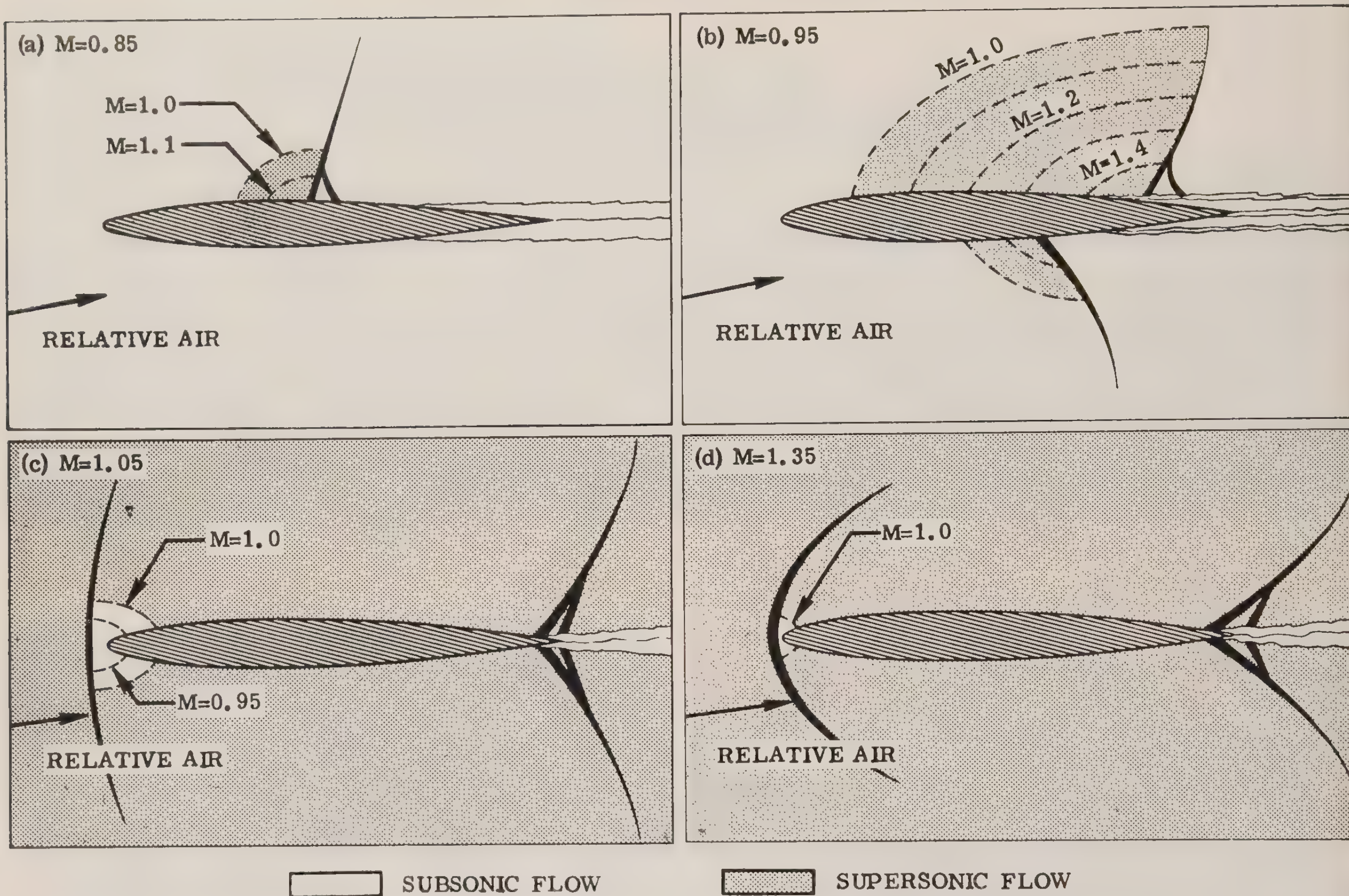
INSTRUMENT *panel in the E18S is offered in two deluxe arrangements, basic SAE configuration with two subpanels (above) and an alternate*

LONGER *tail strut provides better landing angle, improves taxiing visibility, Richards (left) tells Fisher*

ACCORDION-*type door to pilot's compartment replaces cumbersome hinged affair, permits better flexibility in passenger seat placement as shown here*

ANGLED *and contoured tip (above) adds two feet to wing section, increases single-engine climb and ceiling*

FIGURE 1 TRANSONIC FLOW PATTERNS



Problems of HIGH-SPEED FLIGHT

by Earle S. Hodder

Aerodynamics Supervisor,
North American Aviation, Inc.

Since World War II many new stability, control and operational problems have arisen as a result of the demands for higher aircraft speeds. It is the purpose of this article to review some of these problems with regard to their importance to the supersonic airplane.

Flow Characteristics

Since a large percentage of the high-speed flight problems are the result of Mach number effects, a brief review of the changes in airflow about an airfoil as a function of Mach number is in order. Typical flow patterns during the transition from subsonic to supersonic flow are shown in *Fig. 1* for Mach numbers of 0.85, 0.95, 1.05, and 1.35. These flow patterns are common to all airfoil sections, although for sharp-nosed sections and for thinner sections the local regions of supersonic flow are less pronounced and the shock magnitudes less severe.

For any given airfoil, depending on its shape, the flow pattern below some Mach number is entirely subsonic. For the airfoil chosen for this discussion a small region of supersonic flow first begins to appear on the upper surface at a free-stream Mach number of 0.8 (*Fig. 1-a*). Generally, this region of supersonic flow appears first near the maximum thickness of the airfoil at the condition termed the "critical" Mach number, *i.e.*, that at which the air velocity at some point on the airfoil section reaches the speed of sound. The heavy black line extending approximately normal to the airfoil contour is the compression shock wave. This shock wave occurs because the high negative pressure is maintained quite far aft on the airfoil requiring a rapid transition back to ambient conditions at or near the trailing edge. This transition is in the form of a pressure wave and since the wave is propagated in air at the speed of sound it is commonly called a "compression shock wave." These waves always occur when the flow is decelerated from a supersonic velocity to a subsonic velocity and are accompanied by abrupt changes in velocity, pressure, density, and temperature. The higher the negative pressure over the airfoil the more severe the shock. Thus, increasing the lift by pulling "G" increases the shock intensity. Increasing the velocity of the airflow from subsonic to supersonic occurs smoothly without the formation of the strong shock waves.

Referring to *Fig. 1-b*, the region of supersonic flow over the airfoil at Mach 0.95 has increased considerably over that for M=0.85. Furthermore, the normal shock wave has moved farther aft on the airfoil, and a small

FIGURE 2 F-86D WING WAKE SURVEY

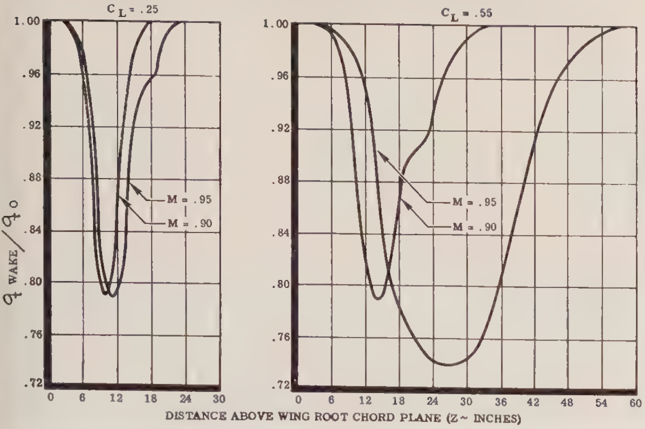


FIGURE 3 WING DROP CHARACTERISTICS

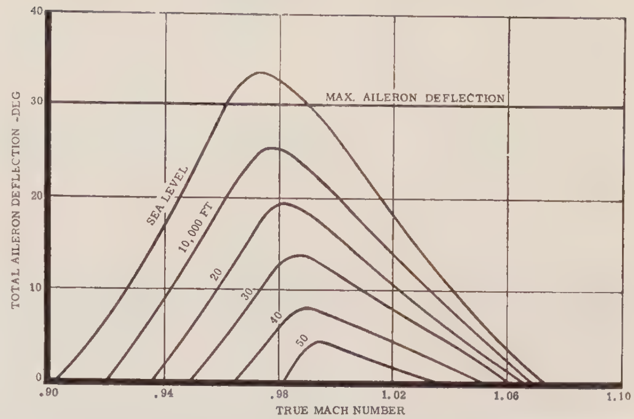


FIGURE 4 SHOCK WAVE PATTERN

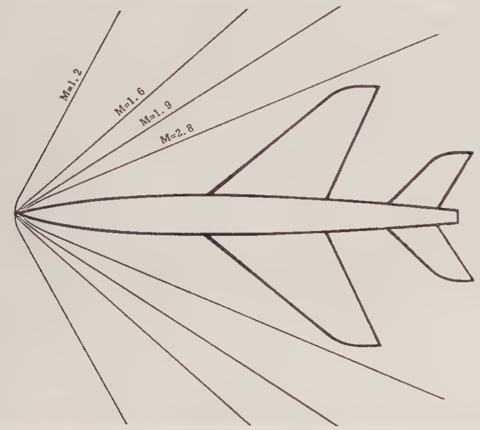
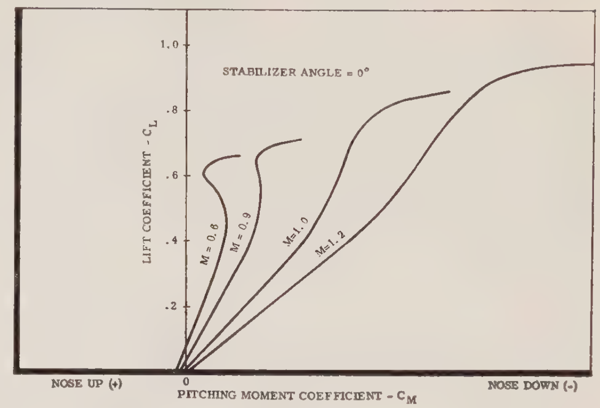


FIGURE 5 STATIC STABILITY—C_L VS C_m



region of supersonic flow has appeared on the lower surface with an accompanying small normal shock.

Fig. 1-c shows the upper and lower surface normal shock waves have moved farther aft on the airfoil almost to the trailing edge. In addition to the flow deceleration from supersonic to subsonic velocity through these wave formations, it is also bent away from flowing along the airfoil surface to the direction of the free-stream velocity. The detached shock wave shown forward of the airfoil is also caused by deceleration of the airflow from supersonic to subsonic velocities and is called the bow wave. On a round-nose airfoil (like the one shown in *Fig. 1*) there would always be a small region of subsonic flow and the bow wave would be detached from the airfoil. For all practical purposes the bow wave on a sharp leading-edge airfoil could be considered attached to the leading-edge although there probably would be an extremely small region of subsonic flow since even a needle point has physical thickness.

Increasing the Mach number to 1.35 (*Fig. 1-d*), the upper and lower surface normal shock waves reach the trailing edge and are bent aft more than for the lower supersonic velocities. The region of subsonic flow at the leading edge is smaller and the bow wave has bent considerably more around the airfoil.

One other thing of importance is the flow separation beginning near the normal shock wave. This separated region is extremely thick for thick airfoils and, of course, becomes progressively thinner as the airfoil thickness decreases. This separated air in the boundary layer is quite oscillatory and affects the normal shock waves so that their position also moves fore and aft and generally "jumps around" on the airfoil in the transonic range. This phenomena of separated flow aft of the shock is commonly referred to as "shock stall" and causes such things as buffet and control surface buzz or tap.

The energy losses through the shock and in the separated region of flow are also characteristic of the drag rise in the transonic range. An example of the thick wing wake resulting from these shock wave formations is shown in *Fig. 2*. This figure shows the dynamic pressure measured in the wing wake just below the horizontal stabilizer of an F-86D at Mach 0.9 and 0.95 for lift coefficients of 0.25 and 0.55. These data are plotted as the ratio of dynamic pressure measured at the tail (q_{wake}) to the free-stream dynamic pressure (q_o). The wake surveys shown were taken at an altitude of 40,000 feet. The lift coefficient of 0.25 corresponds to approximately 1G flight and the 0.55 lift coefficient corresponds to approximately 2.3G turning flight.

Note that a C_L of 0.25, increasing the Mach number from 0.9 to 0.95 increases the thickness of the wake only about 30%. At a lift coefficient of 0.55 the thickness of the wake (measured at $q_w/q_o=1.0$) increases approximately 100% by increasing the Mach number from 0.9 to 0.95. The area under these curves, which is a measure of the energy loss in the wake, changes even more than the wake width. For the lift coefficient of 0.25, increasing the Mach number from 0.9 to 0.95 increases the area under the curve by 40%, while for $C_L=0.55$ the area increase is 170%.

With the foregoing brief review of the flow about an airfoil in the subsonic, transonic, and supersonic range, let's now get into a few of the problems of high-speed airplanes.

Wing Drop

This characteristic is common to many airplanes in operation today. In general, it occurs near the drag rise and is the result of the compressibility effects pre-

FIGURE 6 STATIC STABILITY

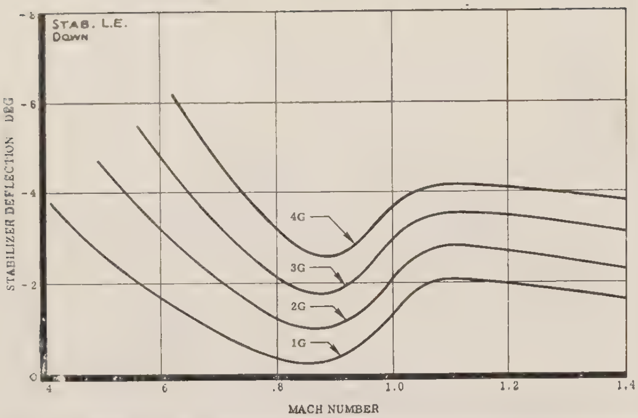


FIG. 7 MAXIMUM LEVEL AND STALLING SPEEDS

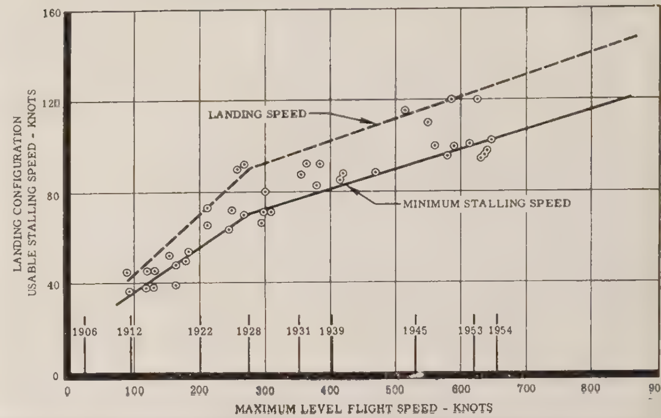


FIGURE 8 LOW SPEED RATE OF DESCENT

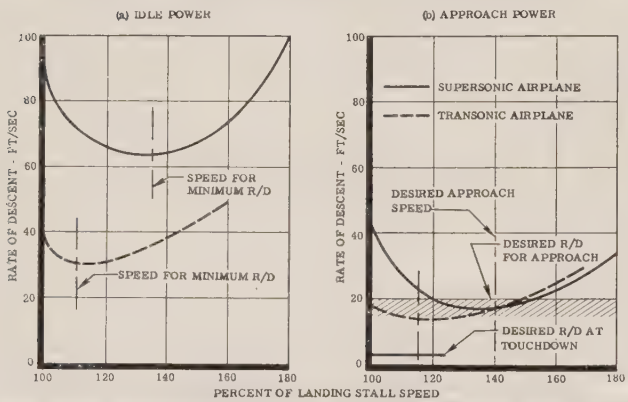
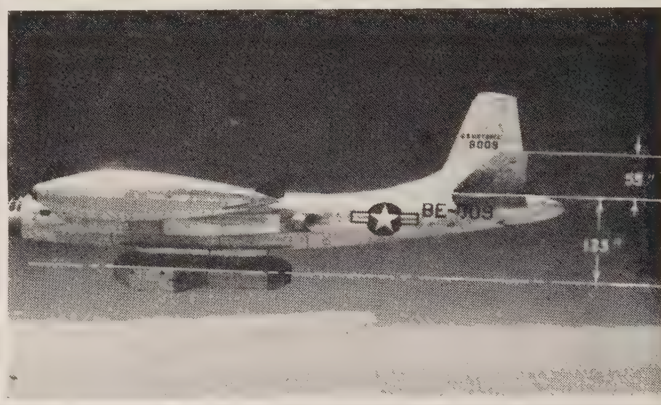


FIGURE 9 B-45 ENGINE TEST BED



viously discussed. As the airplane Mach number is increased into the transonic range, normal shocks will occur on the wing. Since surface irregularities can cause the shock to occur earlier than would happen on a perfectly smooth section, one wing panel generally shocks before the other due to the small differences encountered as a result of manufacturing tolerances. This shock is accompanied by a flow separation extending downstream from the shock and results in a loss of lift and "wing drop" or "roll off" in the direction of the wing first encountering the shock. The wing-drop tendency is further aggravated by deflecting the aileron to counteract the roll. This is because the "down" aileron required on the down-going wing tends to increase the upper surface negative pressure which results in an increased shock intensity with further loss in lift on this wing panel. Of course, since the conventional aileron control is operating in the separated flow region, its effectiveness is relatively low, all of which further complicates the problem, particularly for the pilot.

The wing-drop problem also is aggravated by wing twist resulting from the aileron deflection. This condition makes the wing drop become more severe at low altitudes and, depending on wing stiffness, may actually limit the maximum speed of the airplane. This would be particularly true of airplanes designed to low limit load factors such as bombers and transports.

Fig. 3 shows the aileron deflection required to hold the F-86D wings level in the wing-drop range at various altitudes. For the particular F-86D on which these data were measured there was insufficient aileron to overcome the rolling tendency at altitudes below about 5,000 feet. The large effect of altitude on the amount of aileron required to hold the wings level is attributed to aero-elastic effects. These data are considered representative of the wing-drop characteristics of the average F-86 airplane. Actually, some F-86s roll to the right in wing drop while others roll to the left, and a few have little or no roll tendencies at all. As mentioned before, these wing-drop variations from plane to plane are the result of manufacturing tolerances.

Also as stated earlier, shock waves are more severe on thick wing sections than on thin sections. On the F-86 series airplanes the average wing thickness measured perpendicular to the 25% chord line is 10.9%. Measured in the streamline the average thickness is 9.2%. Decreasing the average wing thickness to 7 or 8% in the direction normal to the 25% chord (6 or 7% in streamline direction) undoubtedly would minimize the severity of the shock to such an extent that wing drop would be essentially eliminated. On a straight-wing airplane the wing thickness probably would have to be as low as 5% to minimize the wing-drop problem to a negligible amount.

The current trend in fighter planes is toward thinner and thinner wings, which probably means that the supersonic fighter will not have the wing-drop problem. Insofar as bombers and transports are concerned, however, they may still encounter some wing-drop tendencies. This could occur because of the relatively low wing stiffness of the bomber or transport, compared to the fighter. For these aircraft, even a mild shock intensity differential between one wing and another, combined with a low torsional stiffness might still cause some noticeable wing drop. The effect of the less rigid wing torsionally, of course, enters into the picture when the ailerons are deflected to counteract the differential shock effects on the wing.

Although right now it does not appear that the wing-drop problem as we know it today on the transonic airplane will be as serious on the supersonic airplane, there is possibly one (*Continued on page* 34)

1955—CESSNA 180

A much-talked-about feature of the 1955 four-place Cessna 180, introduced to the flying businessman in January, is a new quietness in flight, the result of a combination of engineering changes and an improved Continental 0-470-J engine. The 0-470-J engine is operated with an inch less manifold pressure and 100 less rpm and this, combined with relocation of the cabin air intake openings to a position outside the propeller arc, and the quarter-inch "free-blown" Plexiglas windshield makes for what Cessna Aircraft calls an "excellent silence report." Pilots and passengers who have flown the new 180 are in complete agreement on this "silence report."

Another engineering change in the 1955 model involves the landing gear which has been re-angled so that tire-to-ground contact is 3 inches further forward than in previous 180's. This change offers greater ease of handling in landing as well as added safety in taxiing under all conditions. For crosswind operations, Goodyear's castering wheels are available as optional equipment.

The 180 retains the two wide doors of the previous model, but offers a new arrangement of the entrance step for easier access to either the front or back seats. The front seats have been redesigned and restyled for improved comfort and interior decor. Both front seats are individually adjustable, thus eliminating the "cramped position" for the long or short-legged pilot or passenger on cross-country flights. The luggage compartment, located aft of the back seat, is accessible in flight and also is furnished with an outside luggage door. A large cabin heater and two airline-type push-pull ventilators add to pilot and passenger comfort.

The Continental 0-470-J engine offers 225 hp and drives an all-metal constant-speed propeller, The control wheel for the 180's fully adjustable horizontal stabilizer is located between the two front seats, and the shockmounted non-glare instrument panel assures accurate instrument readings. Provisions also have been made for optional flight instruments and the installation of three radios without sacrificing the map compartment space.

Optional equipment for the new Cessna 180 includes Edo floats or skis, and the prospective 180 owner has a choice of four exterior colors and two harmonizing interior color combinations. The exterior colors are Mallard Green, Desert Red, Tangerine, and Yellow; the interior combinations are brown and beige or tourquoise and beige.

Performance-wise, the Cessna 180 cruises at better than 150 mph and has a range of more than 600 miles or 4½ hours. Its service ceiling is 19,800 ft, and it has an initial rate of climb of 1150 fpm.

Price of the Model 180 remains $12,950 FAF Wichita, Kan. The single-engine Cessnas long have been popular with business-plane operators and, in many instances, have supplemented fleets of multi-engine aircraft to offer a greater availability of air transportation for company engineers, technicians, salesmen, etc. The Model 310 twin-engine Cessna rounds out Cessna's line of business aircraft and makes it one of the few aircraft companies offering economical "answers" to practically all business air-transportation needs.

LEFT-HAND *row of this slope-line approach light system on Runway 4 at Idlewild Airport was destroyed during a low-weather approach of an Italian Airlines DC-6B. Pilots claim slope-line creates a mirage effect under certain atmospheric conditions and does not give centerline guidance*

CENTERLINE *approach lights on Runway 4-22 at Newark Airport (right) are considered by pilots as best ever devised for accurate approaches to center of runway. Lights are condenser discharge type. This type of lighting soon will replace debatable slope-line system at New York's Idlewild Airport*

by Franklin D. Walker

Approach Light Standardization

Dutch-designed flush light promises to settle 15-year debate on question of best approach lighting system for Air Force and Air Carrier operations

Approach lighting has been the subject of continual debate with- n the industry for the past 15 years, ut the result of all the discussion is hat today we have what one airline xpert accurately described as a ational hodge-podge of approach ghts.

Instead of the standardization veryone agrees is necessary in this nportant area of visual aids, there re at least six distinct types of ap- roach lights and various combina- ons of them in use at major airports. hey include slope-line, high-intensity ft-hand row, centerline, Air Force ver-run area, Neon left-hand row, nd Neon centerline.

For example, three different ap- roach lighting systems are used in he New York area alone. LaGuardia as a left-hand row system in which he inner 1500 ft is made up of high- ntensity lights. Newark has a center- ne, flashing sequence system, and ew York International had, until he Italian Airlines transport des- royed it, the debatable slope-line ystem.

Whether the slope-line approach ghts on Runway 4 at New York nternational contributed to the Ital- on Airlines DC-6B accident in De- ember will not be known until CAB nvestigators report their findings. However, experienced pilots point out hat slope-line is an obsolete system vith built-in hazards under certain tmospheric conditions. When condi- ons are right, slope-line creates a mirage" effect which leads a pilot o believe he is too high and ap- roaching nose-down. Another illu- tration, they report, is that at times vhen an aircraft is on the glide path he runway appears to be tilting up. The two rows of lights converging on he runway threshold create an artifi- ial perspective.

Everybody concerned in the avia- ion industry agrees that slope-line s obsolete and there is general agree- nent on standardization with center- ine as the basic configuration. In fact, TSO-N24 issued by the CAA on June 30, 1954, established a national standard for approach lighting and based it on the centerline concept. Its requirements were formulated by the Ground Aids subcommittee of the Air Coordinating Committee "in the interest of safety, regularity and efficiency of aircraft operations."

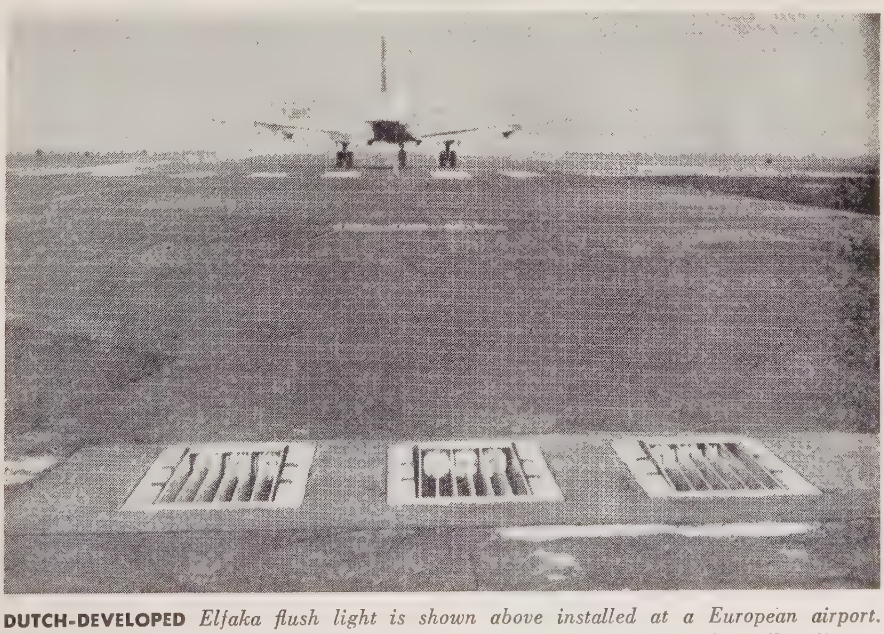
Announcement of a national standard on approach lighting did not, however, bring an end to the seemingly endless discussions of the subject. Many table-pounding sessions have been held since TSO-N24 was issued, and the frequency of such meetings has been stepped up since the Italian DC-6B ripped through the slope-line installation at New York International with heavy loss of life.

Protagonists in the current hassle include the major air carriers and their pilots, the U.S. Air Force and the CAA, and the major issue is how best to adapt the national centerline approach light standards to the joint civil-military airports.

The national standard developed by the ACC through joint action of its members and the industry sets up three approach lighting configurations. Configuration "A" is basically a 3,000-ft. centerline extending to the runway theshold. Configuration "B" has a 20-bar centerline row for 2,000 ft and right and left side bar lights for the 1,000-ft over-run area. Configuration "C" is for Navy usage only and, therefore, is not part of the controversy. Systems of less than 3,000 ft may be installed where special requirements of the military exist or where terrain conditions prevent installation of a full-length row. The absolute minimum length is 1500 ft.

Configuration "A" is the national standard for approach lighting, except where the military requires an over-run or under-shoot area. The standard at such fields then becomes Configuration "B." It is at this point that the airlines and pilots on one side and the Air Force on the other begin to disagree. The air carriers

(*Continued on page 42*)



DUTCH-DEVELOPED *Elfaka flush light is shown above installed at a European airport. This type of light soon will be tested in over-run area at the Knoxville Airport.*

FEBRUARY 1955

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Wings Club, New York

"DME... for Enroute & Approach Navigation"

DME ROUND TABLE, *held at the Wings Club, New York City, was attended by (left to right, standing) Capt. Kim Scribner of Pan American World Airways; Gil Quinby of National Aeronautical Corp.; Bob Froman, Associate Director of Bureau of Safety Regulations, CAB; Craig Timmerman, ATA; and John Sommers, CAA, who attended as an observer. Other participants were (left to right, around table) Ernest W. Burton of the CAA; J. H. Lamb, Jr., Chief Pilot, American Oil Company; R. E. Dowsley of Hazeltine Electronics Corp.; C. I. Rice, Bendix Radio; Moderator David D. Thomas, CAA; Remington R. Taylor, Mohawk Airlines; Art Ward, Atlantic Aviation; W. H. Wilson, Hazeltine; and Donald Stuart of CAA's TDEC*

Moderator David D. Thomas *(Deputy Dir., Federal Airways, CAA):* "Our discussion today involves one of the most important navigational developments available, and it's a subject of considerable interest to all who fly. The problem of distance information has been with us ever since there have been vehicles of transportation and it is particularly acute in the case of the airplane. In the past we have made awkward attempts to obtain distance information through fixes, fan markers, intersections, etc., but now we have available a means of obtaining distance information continuously and precisely.

"As you know, distance information was stated as a requirement in SC-31. At the present time we have about 316 DME ground stations installed and flight checked. Of these, 231 are operating; the remaining are not in operation due to lack of funds. Our present program calls for 454 DME stations to be located at all VOR and most ILS sites. That will be expanded as the VOR's and ILS' expand, but whether or not we will have DME at every ILS location is subject to question. We have fair DME coverage over most of the major routes of the U.S. now, and by next year we expect to have rather complete coverage.

"It might be well to begin our Round Table today with some discussion of the availability of airborne equipment. Gil Quinby?"

Availability & Accuracy

Gil Quinby *(Sales Mgr., NARCO):* "NARCO has been in production on airborne DME for nine or 10 months. At the present time we are backordered, and deliveries are running about six weeks after order. Distributors' and dealers' stock piles are in fair shape and we feel we have enough DME's to fill immediate requirements."

C. I. Rice *(Mgr., Aviation Sales, Bendix Radio):* "We have been delivering production DME equipment for over a year and have overcome our initial production and service problems. We also have been helping our distributors and dealers establish adequate service and test facilities so

that the equipment can be maintained in the field.

"We have many customers, particularly in the business-aircraft field, who are using DME, and the reception has been excellent. In fact all the pilots I have talked to who have used DME are sold on it."

W. H. Wilson *(Ass't Vice Pres, Hazeltine Electronics)*: "As you know, Hazeltine pioneered the development of the DME system and produced the first CAA Type Certificated airborne equipments. Today, we manufacture all the ground DME equipment for the CAA, and we finished delivery of some 450 units a year ago last summer. Despite a limited budget, the CAA is doing a fine job in getting the stations on the air, and we are pleased with the way the ground equipment has operated."

R. E. Dowsley *(Sr Project Admin, DME Systems, Hazeltine Electronics)*: "I might add just one thing—we have achieved the development of a DME coordinator which permits the use of standard 1,000-mc test equipment for proper servicing of the DME."

David Thomas: *"Servicing is a very important part of the whole DME picture. Mr. Ward, would you comment on that angle?"*

Art Ward (*Mgr, Electronics Dept, Atlantic Aviation*): "Basically, the servicing problem involves adequate test equipment and personnel. Aside from the investment in DME equipment, consideration should be given to the development or adaptation of one set of test equipment for use with various types of DME. It would be ridiculous to have to invest in different test equipments for each DME set available."

David Thomas: *"Don Stuart, you have been connected with the development of DME since its inception. Can you tell us of any further development that might be planned for it?"*

Donald M. Stuart (*Dir, TDEC, CAA*): "I'd say development is completed on DME—we have the country pretty well covered with CAA installations right now. DME is something a pilot can get accustomed to in a hurry, and miss terrifically if he doesn't have it. The things DME does for you are important and I look for wide-spread acceptance of it to practically eliminate air traffic control problems.

"That may seem like a rash statement and perhaps I'd better explain it. DME offers such things as radar identification. Identifying an aircraft on radar has been a problem, and to accomplish it the controller asks the pilot to make a turn or perform some sort of maneuver so that he can tell what plane he is looking at. When you know where you are all the time and have a running fix, you can call radar and tell them precisely where you are, thus accomplishing identification then and there.

"Having a running fix is a novel situation compared to what we have done in the past. The ability to get over fixes purely on a visual basis via VOR-DME certainly takes a load off the air crew whose ears are busy with communications and who haven't time to listen for aural fixes.

"Perhaps in the future the development of a speedometer for aircraft will be feasible. We can have a speedometer that will tell us how fast we were going two or three minutes ago, but we can't have one very readily that will tell us how fast we are going right now."

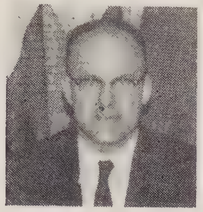
David Thomas: *"That would be a speedometer based on DME?"*

Don Stuart: "Yes, that would be about the only way we'd have of getting a continuous-reading speedometer. Of course, you can have it right now by timing yourself with a stop-watch over a given distance, but I think this could be built-in to automatically give you your speed as of a few minutes ago."

David Thomas: *"Before we get off the equipment subject, I wonder if Mr. Burton would like to comment?"*

Ernest W. Burton (*Flight Opr. Specialist, Aviation Safety, CAA*): "DME is an accurate piece of equipment, and we of CAA would not want to see the equipment manufactured to be anything less than absolutely accurate. When you are predicating height over obstacles by DME, you have to have an accurate piece of equipment. Although we can't require the operator to possess certified equipment, we'd like to point out that

ROUND TABLE PARTICIPANTS



MODERATOR D. THOMAS is Deputy Director, Office of Federal Airways, CAA. He is licensed pilot (Com'l) with Instrument and Multi-Engine rating; is a member of IAS.

ERNIE BURTON was pilot with Eastern Air Lines and Pan American before war; served with ATC during the war. He has been with Aviation Safety, CAA, since 1945.

J. H. LAMB, JR., has been a business pilot for past 9 years. He was a B-26 pilot during World War II, and joined American Oil Company in '45; is now its chief pilot.

ART WARD, Manager of Electronics of Atlantic Aviation at Teterboro, N.J., joined Atlantic in 1946 after serving with Navy; worked with NRL in DF development.

R. R. TAYLOR is Superintendent of Communications for Mohawk Airlines. He is a graduate radio engineer and is in charge of ANDB-sponsored evaluation of DME-DIB.

C. I. RICE, Manager of Aviation Sales for Bendix Radio, is a grauate electrical engineer and a Senior Member of IRE. He holds pilot's license; joined Bendix in '53.

CRAIG F. TIMMERMAN served as Air Traffic Control Coordinator, Chicago, CAA from 1941 to '48; joined ATA. He is Director, Air-Nav/Traffic Control Div., ATA.

W. W. WILSON is Assistant Vice President of Hazeltine Electronics. He was a member of RTCA's SC-31; directed development of first DME air, ground equipment.

R. E. DOWSLEY, Project Engineering Section head, Hazeltine, has been Senior Project Engineer on the DME system development and component manufacture since '48.

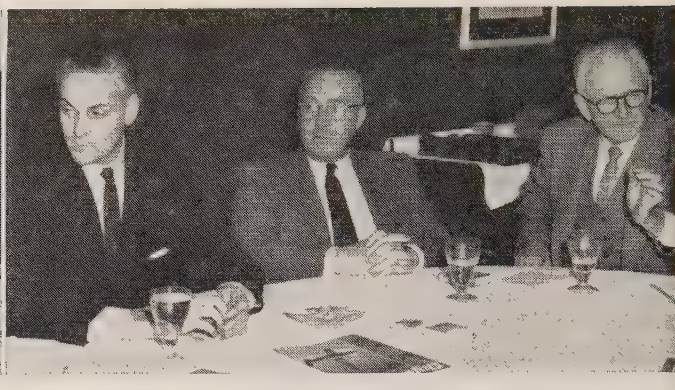
ROBERT L. FROMAN served with the Air Force during World War II. He joined the CAB in 1946 and became Associate Director, Bureau of Safety Regulations, in '51.

CAPT. KIM SCRIBNER served with the Air Transport Command during World War II. He joined Pan American in 1942; became a Captain in '44, Div. Chief in '51.

DONALD M. STUART has been Director of the Technical Development Evaluation Center in Indianapolis since 1943. He began his career in 1934 as radio engineer.

GIL QUINBY, Aviation Sales Manager for NARCO, is graduate electrical engineer. During war, he was Naval officer attached to Naval Radio Laboratory in Washington.

"HAZELTINE *now has a DME coordinator," said R. E. Dowsley (right), "which permits use of standard 1,000-mc test equipment"*



"DEVELOPMENT *is complete on DME," reported Don Stuart (center), "and the country is well covered with CAA installations"*

the use of equipment that is only marginally accurate will reduce the advantages of having the equipment. We should encourage the manufacture of accurate equipment, and discourage the purchase of so-called cheaper type equipment unless that cheaper type maintains the desired accuracy."

C. I. Rice: "Bendix equipment is manufactured to a specification of 3% or ½ mile, whichever is greater. This applies over a wide temperature and environmental range, as well as under other conditions. In other words, the accuracy at 50 miles must be better than a mile and one-half to meet our specification. Actually, we are achieving better accuracy than that. It comes down to an accuracy of ½ mile at the closer ranges. At any range you are positioning yourself accurately within a very small portion of airspace compared to that of other navigational methods."

Don Stuart: "In operating a number of airborne equipments—NARCO, Bendix and Hazeltine—we have found it entirely feasible to keep within 1½% or ¼ mile accuracy, all of which exceeds the specified limits by 2 to 1. We know we are getting this accuracy because it checks out when we remove the airborne unit for the laboratory test after some 100 hours of flying."

Gil Quinby: "That brings us back to the question of test equipment that Art Ward mentioned. With the proper test equipment, you can calibrate a DME under a given set of conditions about as close as you can read the distance indicator, and on the distance indicators in service today the limit of readability is something less than ¼ mile, perhaps approaching $^{1}/_{10}$ of a mile. I'd like to ask Ernie Burton what he considers to be the limiting accuracy."

Ernie Burton: "The present figure of ½ mile or 3%, whichever is greater, is a very satisfactory tolerance, and we feel we can operate with this tolerance provided that standard is maintained. Although we're asking for ½ mile or 3%, we know we are getting twice that accuracy. Occasionally, however, there will be a set that does not meet those tolerances. We want to make sure some manufacturer doesn't come out with a set that exceeds them. We have found that when a person has such a set in his aircraft, supposedly just for VFR operations, he is tempted to use it for IFR operations. The equipment on the market today is excellent and meets all foreseeable specifications. We want to keep it that way."

Capt. Kimball J. Scribner (*Chief Pilot, Atlantic Div., Pan American World Airways*): "As a potential user of DME equipment, PAA has been evaluating various DME prototypes and it appears that the ½ mile or 3% tolerance figures are being borne out in our tests. As a matter of fact, one of our real problems is the closeness of measurement. We are using our DC-3 training fleet to test equipment in the New York area, and we recently installed the NARCO system in our B-23 executive aircraft. In our future DC-7 fleet, we're planning to use dual units. To date we have run evaluation tests on one DC-6B, but even though we are limited domestically in our routes (along the eastern seaboard) those tests have revealed the accuracy to be well within the prescribed limits. In some cases the audio identity has been poor, but we feel those technical aspects can be resolved.

"We have found that DME enables an accuracy in ETA's that heretofore has not been realized, and we look forward to enjoying the real value of DME in our jet operations of the future. The industry is faced with the problem of expediting clearances of jet aircraft and reporting accurately their rapid descents into concentrated metropolitan areas. We think there will lie the real value of DME."

Art Ward: "I'd like to make a point on accuracy, installation-wise. In the cockpit we are influenced by parallax, and from our experience parallax error exceeds the equipment error, particularly in the DC-3 and the *Lodestar* where the instrument panel is well below the pilot's line of sight. In the low range, let's say a 5-mile reading, it would indicate 5¼ instead of 5. Also, the word 'estimated' is not going to be a part of the pilot's vocabulary if he has DME. Instead of a time of arrival being estimated, it will be exact."

David Thomas: *"Several important points have been established, particularly the fact that we are getting far greater accuracies with DME than we have ever experienced in the past with any item of equipment, and we evidently are not now taking full advantage of those accuracies. To my knowledge, this is the first instrument in which reading error is greater than the instrument error itself.*

"Let's move on to operational uses of DME. Until recently, the CAA has not had any specific procedures for the use of DME. Now, however, the CAA has established some based on the use of DME in instrument approaches. Mr. Burton, would you give us a brief summary of these procedures?"

Operation Uses

Ernie Burton: "Procedures involving the use of DME are many. In fact, it appears that we are just beginning to scratch the surface. I'd like to make it clear that in all of our tests we feel that the biggest dividend DME can pay is in increased flight safety. DME will save time, will speed up traffic and, more important, the pilot need no longer guess where he is. That all adds up to increased safety.

"As far as procedures are concerned, we have broken them down into two categories: (1) Enroute, and (2) Instrument Approach. It is in the instrument approach field that we feel that DME-equipped aircraft will en-

joy the earliest dividend, because it can make a single approach and not be dependent upon other aircraft being similarly equipped.

"To date, we have developed about 30 procedures in the instrument approach field. These incorporate all of the thinking of past evaluation and operational experiences, and are based on the premise that the equipment used has the operational accuracy of CAA-certificated equipment. For the first time we have a firm policy on the preparation of these procedures, and that policy is in the hands of our field representatives with instructions to them to develop instrument approach procedures based on these criteria for every location at which there is a DME.

"We anticipate that in the future the VOR instrument approach charts will be labeled VOR-DME charts and that they will be used with increased safety down to the lower minimums and on circling or orbiting approaches by DME-equipped aircraft. We already have experimental procedures based on the charts prepared by Coast & Geodetic Survey and indications are that those procedures are satisfactory.

"We also have put out instructions in the field to integrate DME into the VOR Airway System. The first dividend there for DME-equipped aircraft will be the lowering of minimum enroute altitudes along certain routes. DME fixes will be provided where other fixes do not exist.

"A typical example of this would be on a route between two VOR stations, with no other fixes between them, where the minimum enroute altitude might be 8,000 ft. Air Traffic Control could give a clearance to a DME-equipped aircraft to go down to 5500 ft, if it was all right terrain-wise, and it would not be taking up any space that any other aircraft could use. We feel that would be an early dividend and we have instructed our agents to prepare and send in minimum enroute altitudes so computed. We do not feel that hundreds of changes in altitude should be sent in, but where a realistic operational requirement exists, DME should be used for lowering minimums.

"We also feel that DME is going to expedite holding. A pilot will be able to position himself in the stack with an exactness that heretofore has been impossible. That in itself will speed up all traffic, even for those not equipped with DME. On all these procedures used on the airways we have set up a buffer of 10% or 1½ miles, whichever is greater. That almost triples the 3% or ½ mile buffer set up with respect to equipment accuracy. It means that if you are 20 miles from a station you will be able to make your descent two miles after passing an obstruction located 20 miles out from the station. We feel that will be perfectly safe."

Bob Froman: (*Associate Dir., Bureal of Safety Regulations, CAB*): "The Board contemplates no regulatory action regarding DME at this time, although we are studying DME and its relationship to and use in air traffic control and flight operations set-ups. CAA has taken positive action to set the stage for the utilization of DME, and we will watch carefully the flight operations conducted and the experience gained under these programs. We will assist the programs through required changes in the regulatory structure when they are necessary to expedite or improve the safety of operations."

David Thomas: *"Let's hear from some of the users of DME and get their suggestions regarding the operational aspects of DME. Gil Quinby has had considerable DME experience in a type of aircraft we normally do not associate with DME—the* Bonanza. *Gil, could you tell us of its advantages in the operation of such lighter type aircraft?"*

Gil Quinby: "Speaking strictly as a pilot, if you can afford DME today it is a very valuable aid in ordinary VFR single-engine operations. I say that because of my own experiences in using this continuous position information and the rate of change of position to get ground speed and winds aloft information, to find airports and to solve the many little problems that a non-professional single-engine pilot encounters. It is toward this market that NARCO previously has directed its sole attention on Omni and communications equipment. Our departure from that market with DME is only temporary. The present DME's available to owners are comparatively expensive and heavy. I think there is room in the picture for a simplier, smaller, lower priced DME and NARCO is working in that direction so that the advantages will be available to small aircraft in VFR operations."

David Thomas: *"Captain Lamb?"*

J. H. Lamb, Jr. (*Chief Pilot, American Oil Co.*): "I agree wholeheartedly with Mr. Stuart and Mr. Burton on their description of the present and potential value of DME. I'd like, however, to ask Mr. Burton a question. The present holding fixes are described in time and have been limited to 180 mph TAS. Could DME change the description of the holding pattern to miles?"

Ernie Burton: "I think so, and as far as the 180 mph TAS is concerned that was set to keep aircraft within a specified area."

J. H. Lamb, Jr.: "Isn't it entirely possible that with the speeding up of aircraft this would be hard to maintain under certain conditions, particularly with ice on a high-speed aircraft?"

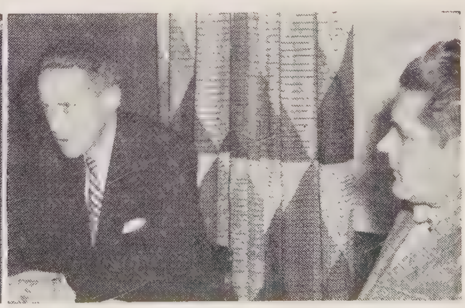
Ernie Burton: "DME would be the answer there and with it you will be able to stay within a set distance. Those distances are established now, and we probably will come out with some established distances for DME-users. When a great number of aircraft have DME, we may be able to reduce the size of the holding area that we now use—19 miles long and eight miles wide.

"Today, if a pilot operates at a speed greater than 180 mph TAS, he must advise ATC of his speed so that measures can be taken to provide him with a greater area and keep other

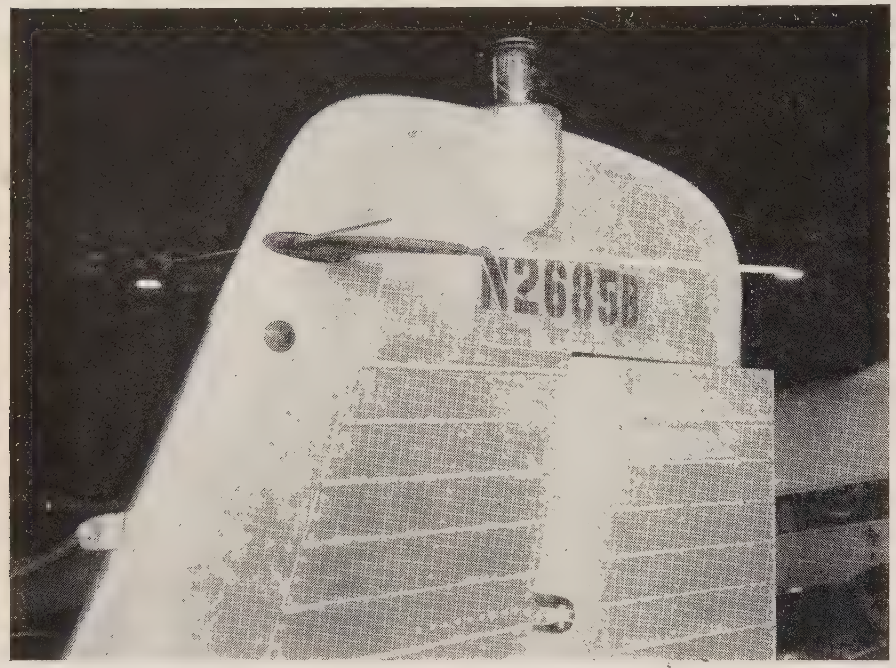
(Continued on page 29)

ATA's *Timmerman (left) reported airlines' purchase of DME equipment not justified*

"DME *is here now . . . use it," said Dave Thomas, "another system is not available"*



"IMPLEMENTING *another system," reported C. I. Rice (left) "would take 10 years"*



ARC VOR-GLIDESLOPE *antenna with a Grimes Rotating Beacon is shown here mounted on the vertical fin of an Aero Commander. The approved installation reduces drag and presents a neat and water-tight installation which can withstand icing without damage to either antenna or aircraft structure. Reading Aviation Service, Inc., Reading, Pa., made installation (labor charge: $149.50); similar one can be made on any single-tail aircraft*

Learstar Wheels and Brakes Now Available for Lodestar Owners

Santa Monica, Calif. Among the features of the *Learstar*, high-performance conversion of the Lockheed *Lodestar*, is the improved main landing gear wheel and brake system. Developers and producers of the *Learstar*, The Aircraft Engineering Division of Lear, Inc., now announce the availability in kit form of this wheel and brake system for installation on all *Lodestars*.

The conversion calls for new Goodyear No. 9540512 wheels and Goodyear No. 9540622 single-disc, three spot brakes. This is the same equipment currently used on the Convair 340. Special Lear parts are provided to modify these wheels to mount standard 15.00 x 16 tires and to effect attachment of the brake assemblies to *Lodestar* torque-plates. The wheel utilizes new flat-base tubes with TR101 valves produced by Goodyear especially for this application.

The complete conversion kit, including new wheels, brakes, special parts, all necessary AN hardware, and installation drawings (but not including tires and tubes) is priced at $3,000.

Lear engineers report the new brakes have more than double the available energy capacity of the old-type multiple-disc *Lodestar* brakes, and should, with negligible maintenance, be lifetime installations on *Lodestars*. In addition, the brakes respond much faster and with less foot pressure, thanks to the system's greater hydraulic pressure at the brake itself.

Both the kit and the installation have been CAA-Approved for the *Lodestar*.

Portable Unit Developed to Test Thermal Switches, Anti-Ice Systems

Fort Worth, Texas. A new unit designed to functionally test the operation of aircraft thermal switches, separately or with fire-detection and anti-ice systems, is now being produced and marketed by B & H Instrument Co. Called the TEMPCAL Tester, the unit makes its test at operating temperature right on the aircraft, and a special relay circuit makes it possible to check switches only on or off the plane. Much time is saved because thermal switches need not be taken to the lab for testing. Also, using a selected part of the TEMPCAL circuit, cylinder head thermocouples and their circuits to the flight deck instruments can be checked. TEMPCAL heater probes generate and apply heat of a predetermined degree to the thermal switch or thermocouple through a voltage regulator. A temperature of 800°F is reached in about 8 minutes for quick maintenance checks right on the aircraft.

An accuracy of plus or minus 5°F is guaranteed with temperatures ranging from 0°F to 800°F. Heater probes used for cylinder head thermocouples are guaranteed an accuracy of plus or minus 4°C at 0° to 300°C operating temperatures. The TEMPCAL Tester not only checks the operation of the "switch," it enables easy recognition of errors in the circuit.

Construction Begins on New Castle County Airport Terminal Building

Wilmington, Del. Work is progressing on the new $451,939 Terminal building at the New Castle County Airport at Wilmington. When the building is completed, operation and ticket space will be occupied by Allegheny, American and Eastern Air Lines, and a main dining room, overlooking the field and seating 120 persons, will be operated by K & M Restaurants, Inc., of Washington, D.C. There also will be a coffee shop, cocktail lounge, a special banquet room, Weather Bureau offices, Airport Management offices, and a new modern control tower.

This new facility will isolate the civilian activities at the field from the USAF cantonment area and make possible a better joint-use program.

The headquarters of Atlantic Aviation Service, Inc., also will be located near the Terminal, thus offering better service to business aircraft using the field.

G. Edwin Petro is manager of the airport.

New Engine Cleaner Cleans Without Removing Cylinders

Teterboro, N.J. The new Aero Power Combustion Chamber Cleaner, manufactured by Kent-Moore and marketed by Rice Peterson Sales, Palo Alto, Calif., is now available from Van Dusen Aircraft Supplies. The new cleaner permits a thorough cleaning of aircraft engines without removing the cylinders. Operated solely by air pressure, the cleaner blasts a non-corrosive, non-abrasive cleaning agent into the closed cylinders through an adjustable nozzle attached to one of the spark plug ports. Ricochet action of the cleaning agent loosens carbon and other foreign deposits which are blown out of the cylinder through an outlet hose attached to the spark plug port and returned to a disposable filter bag.

Van Dusen Aircraft Supplies, at Teterboro, Minneapolis, Washington, D.C., and Boston, has been named distributor of the engine cleaner unit.

Port Authority Establishes Fees at Teterboro Airport

New York, N.Y. As of January 1, 1955, aircraft weighing 2500 lbs or more were subject to a landing fee at Teterboro Airport.

Teterboro fees range from $2.50 per take-off for aircraft weighing between 2500 and 7500 lbs to 20 cents per 1,000 lbs of maximum gross weight for aircraft weighing

ver 7500 lbs. If they prefer, owners of aircraft in the 2500 to 7500-lb class may use he airport on an alternate basis of $10 a nonth or $100 a year for unlimited use of he field. As in the past, aircraft parking rrangements at Teterboro are made hrough the individual fixed base operators.

The Port of New York Authority, owners and operators of the field, declared that he establishment of these fees was necessary to help defray the cost of improving nd maintaining the airport which, in 953, handled 101,400 take-offs. Of this umber, 17,300 were corporate aircraft ake-offs, 12,900 were private planes, 1,000 vere military and government, and 68,800 vere local school flights.

Civil aircraft weighing less than 2500 lbs ontinue to use the field without charge.

ow-Cost, Light-Weight Oxygen Unit nnounced for Business Aircraft

ancaster, N.Y. The operators of such business aircraft as the Aero *Commander*, the Piper *Apache* or *Tri-Pacer*, the Beech *Boanza* or *Twin Bonanza*, the Cessna 170, 80, 190 or 310, the *Navion* or the *Twin Vavion* welcome news from Scott Aviation Corporation of the development of a new ow-cost, light-weight oxygen console for se aboard their aircraft. Costing about 300, the equipment features a console veighing only 3 lbs and includes a high-pressure ON-OFF valve, a regulator and ve mask outlets. The oxygen supply cylinder is mounted in the baggage compartment, with the console attached anywhere n the cabin. The console is joined to the xygen supply system via a length of stainless steel, high-pressure tubing. The console measures 7½ x 8 x 1½ inches, and is imple to use. It is set at cruising altitude nd the masks, whatever number up to five re needed, are plugged in. Each outlet is n ON-OFF valve.

Use of this oxygen system enables business aircraft to fly above the "weather," aster, safer and more comfortably for its passengers.

RIGORS *of winter one day and the sun of Florida the next; such occasionally is the life of a business pilot. Here, Capt. Skip Wittner and First Officer Bob Quelch who fly Kewanee Oil's DC-3 enjoy a day off*

. . . . in the business hangar

George L. Culver's *Twin-Bonanza*, based at Newcastle, Wyoming, has been equipped with a Flite-Tronics CA-1 audio amplifier. The equipment was installed by Aero Electronics, Inc., of Phoenix, Arizona.

Ed Armstrong and Jim Smith flew both of S. W. Richardson's DC-3's from Fort Worth to Executive Aircraft Service at Dallas for 100 hour inspections.

A new Super-18 Beechcraft has been delivered to Merritt-Chapman & Scott of New York City by Atlantic Aviation at Teterboro. Atlantic installed an extensive radio system including Bendix Omni, Narco DME, and Sperry C-4A Gyrosyn compass. Bob Plump is pilot for the new aircraft owners.

The Grumman *Widgeon* owned by Texas Gulf Sulphur Co., Newgulf, Texas, has been equipped with a Flite-Tronics MB-3 Marker Beacon receiver. Continental Radio, Houston, made the installation.

A new deluxe executive DC-3 is on order from Remmert-Werner by Scott Paper Company. The business '3 will have R-1830-94 engines, Sperry Gyrosyn compass, H-5 horizon, Collins 17L-51R communications, ARC-1 standby VHF, dual Collins Omni, Bendix Omni-Mag, two Collins 51V glide slopes, dual Bendix MN62 ADF with RMI, Bendix MN53 marker with Collins 37X flush antenna, an ARC F-11 isolation amplifier, and an RTA1B. As yet no pilots have been named to occupy the front office of the new business plane.

Continental Oil Company's Convair 340 has been in the hangar at AiResearch, Los Angeles, for major repairs and modification.

Sinclair Refining Co., Tulsa, Oklahoma, is having its entire fleet of aircraft equipped with Narco Distance Measuring Equipment by Aerotron Radio Co., also of Tulsa. Henry Boggess, in charge of Sinclair's aviation activities, is the new NBAA Chairman.

Owens-Illinois Glass Co., Toledo, Ohio, has added a second Remmert-Werner DC-3 to its fleet of business aircraft. The cabin of the new '3 has facilities for 14 passengers and features three conference groupings of seats, folding tables, an adjustable desk, a dictaphone, automatically controlled cabin heat and a pilots' compartment equipped with the latest in communications and navigation electronics. The plane will carry Owens-Illinois executives, engineers and technicians on business trips throughout the country at speeds over 200 mph. T. A. Kaatz is O-I's NBAA representative, and Rick Rigg is the company's chief pilot.

Goodyear Aircraft Corporation's Convair is now flying with a Narco DME. The installation was made by Airborne Communications, Inc., of Cincinnati.

George Coleman of Miami, Oklahoma, brought his B-50 *Twin-Bonanza* to Atlantic Aviation at Teterboro for installation of a dual ARC Omni and a Sperry H-6 electric horizon.

One of the *Lodestars* belonging to Union Producing Company was flown to Dallas and Executive Aircraft Service for an engine change, 1,000 hour overhaul, tank seal and miscellaneous systems inspection and overhaul. "Cotton" Jeter was at the controls.

Shell Oil of Canada has a new Remmert-Werner DC-3. Powered by R-2000 engines, this '3 is equipped with Goodyear brakes, retracting tail wheel, Edison fire detectors, a deluxe executive interior, plus such front office fixtures as Collins VHF communications, dual Collins Omni and glide slope, Bendix Omni-Mag, dual Bendix MN62 ADF, marker beacon, and RTA-1B, Sperry Gyrosyn compass and H-5 horizon, and Pioneer electric turn-and-bank indicators. The radio panel is edge-lighted; the instrument panel follows SAE recommendations for lighting.

The J. D. Reed Company of Houston, Texas, has installed a CA-1 audio amplifier in its own B-50 *Twin-Bonanza*.

Radio Corporation of America has its DC-3 back in operation after major work by AiResearch Aviation Service at Los Angeles.

Minneapolis-Honeywell's DC-3 has had a Narco DME installed by Minnesota Airmotive, Inc., at Wold-Chamberlin Field, Minneapolis.

Carl Lewis brought the A. R. Staley Milling Company's Twin Beech to Remmert-Werner in St. Louis for a new custom interior which includes large picture windows. An exterior paint job also is being done.

George Bevins, pilot of George M. Brewster's DC-3, has had a Narco DME installed by Atlantic Aviation at Teterboro. Mr. Bevins is Brewster's chief pilot as well as the company's NBAA representative.

Official NBAA Report

NATIONAL BUSINESS AIRCRAFT ASSOCIATION, INC.

(formerly Corporation Aircraft Owners Association)

National Business Aircraft Association, Inc. is a non-profit organization designed to promote the aviation interests of the member firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable business aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. NBAA National Headquarters are located at 1701 K Street, N. W. Suite 204, Washington 6, D.C. Phone: National 8-0804.

Note: New Minimums

The CAA advises that airline minimums for an airport may not be used by CAR 43 operators until revised procedures are published in the *Airman's Guide* or *Federal Register*, unless the operator already has a waiver authorizing lower minimums.

As the minimums are revised in accordance with the "Criteria for Standard Instrument Approach Procedures," they will be published about 30 days prior to the date to be effective. Note the effective date in the *Airman's Guide* beside each revised procedure. Jeppesen and the Coast and Geodetic Survey will revise their charts as the new procedures become effective. *Airman's Guide* will carry the revised procedures and minimums only once. Thereafter, Jeppesen and AL charts will be the only record.

It will require approximately one year for the CAA to revise all approach procedures. In the interim it will be necessary for pilots to know which airports have revised procedures with lower minimums and which ones maintain the old minimums.

The Elements Can Get Tough

Here is a startling report of a faithful and sturdy DC-3 caught in a violent thunderstorm: "A severe updraft brought the nose up to a vertical position in spite of full forward pressure on the controls. The plane went over on its back, and the controls were pulled full back for recovery. After 20 seconds of normal flight, another updraft caused another loop. Then the ship was rolled on its back, and a half loop made to recover. Then it was thrown on its left side to within 200 feet of the ground. After some altitude was regained, another loop occurred, and the plane broke out of the overcast in a vertical dive at 240 mph Indicated airspeed. The crew's strenuous efforts regained normal flight, and the plane proceeded to its destination where a thorough inspection revealed no damage had been done."

Any business aircraft operators experiencing similar unusual conditions in flight should briefly outline the occurrence and send it to NBAA National Headquarters. Maybe we can set up a "Ridiculous as it may seem" section to this report.

Four Committee Chairmen Named

Henry W. Boggess, NBAA Board chairman and aviation director for the Sinclair Refining Company, Tulsa, Okla., has announced the appointment of four committee chairmen, all members of the Board, to carry out regular and special functions of the NBAA in 1955.

"The rapid growth and development of business flying during the past year," Mr. Boggess said, "has necessitated a careful study by these committees of the NBAA policies, organizational structure, and general activities. Our purpose is to expand membership participation at Regional, State and local levels and to increase overall services to member business aircraft owners and operators."

Committees and Chairmen are: Technical Committee—Cole H. Morrow, J. I. Case Co., Racine, Wisconsin; Awards and Convention Committee—Walter C. Pague, ARMCO Steel Corp., Middletown, Ohio; Administrative Committee—Gerard J. Eger, International Harvester Co., Chicago, Illinois; Reorganization Committee—Joseph Burns, Fuller Brush, Hartford, Conn.

Committee members will be announced later.

Cole H. Morrow

Walter C. Pague

Gerard J. Eger

Joseph B. Burns

Business Flying Boom Forecast for 1955

Business flying has become big business and, based on current trends, is going to get far bigger in 1955.

As of the end of 1954, it would be hard to find a more discredited prophet than the one who a year ago was forecasting that many of the some 6,000 business firms now owning and operating business aircraft would dispose of their planes with the expiration of the Excess Profits Tax.

When the E.P.T. ended last December (1953), the use of business aircraft increased instead of diminished and has continued its steady climb up the graph during the past year. There is a growing demand on the part of business-aircraft operators for twin-engine aircraft to replace single-engine types. In many instances, there are plans to supplement the twins with four-engine pressurized models.

Indicative of the trend is the intention of a number of large aircraft manufacturers to produce exclusive business-aircraft models in the 300-mph or better speed range, with pressurized cabins for high-altitude flying. Both piston and turboprop types are proposed, with one manufacturer studying a jet model.

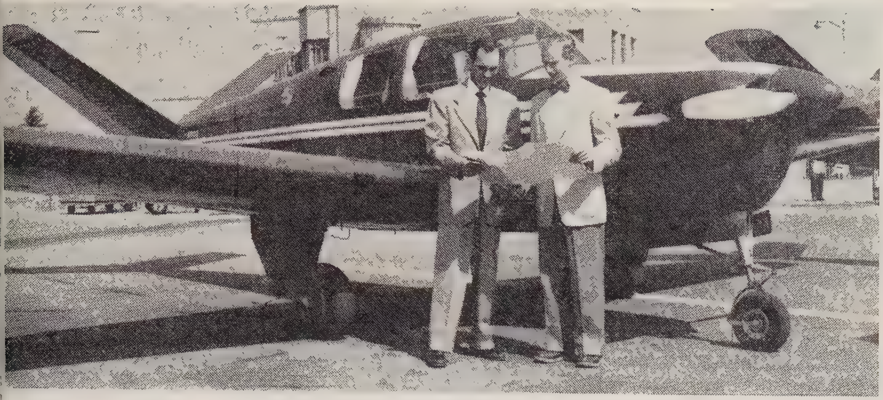
In this connection, it is interesting to quote an excerpt from an editorial that recently appeared in a national publication. "If indeed there has been any doubts still remaining about the potency of the business-aircraft field, those doubts were dispelled by the record-breaking attendance of more than 450 persons at the annual National Business Aircraft Association Convention in Dallas a few weeks ago."

In a recent speech before the Aero Club of Washington (D.C.), Henry W. Boggess, NBAA Board chairman, clearly pointed out the logical reasons for the phenomenal growth of business flying. "Thanks to the airplane," Mr. Boggess said, "a change akin to revolution has taken place in American business methods since the end of World War II. Prior to that time, most national industries operated what may be loosely termed 'centralized' organizations. There has been a transition to 'decentralized' operations which has proved more extensive and more rapid than realized.

"Today, the plants and properties that comprise and house the physical assets of most business organizations, from production to distribution facilities, are more scattered than ever before. No longer can managers step from the office to the automobile and, within the hour, be in contact with their daily problems. Points of production and distribution are now more nearly located either near sources of raw materials or near areas of consumption. More often than not, this means that executives, staff managers, engineers, specialists and department heads must travel hundreds, if not thousands of miles to coordinate and direct their affairs.

"This trend to decentralization has quite naturally caused demands for faster means of travel. No longer is the businessman content to spend three or four days travel-

Meet the NBAA members



AIRCRAFT MARINE *Products' Chief Pilot and NBAA Representative Morton Brown (left) discusses flight plan with Second Pilot Bill Grundon. Company uses four Bonanzas*

Name of Organization: **Aircraft Marine Products, Inc.**

Address: 2100 Paxton Street, Harrisburg, Pa.

NBAA Representative and Chief Pilot: Morton J. Brown.

Nature of Business: Aircraft Marine Products manufactures solderless wiring devices, has offices throughout the United States and subsidiaries in Canada, Puerto Rico, France and Holland. About 90% of all flights include customers.

Aircraft Operated: Four Beech *Bonanzas.*

Most Flights Made to: Customers on the East Coast and in the Middle West. Planes also are used as feeder service to New York airports for long-distance trips on commercial airlines. AMP last year won an NBAA meritorious award for flying over 1,000,000 accident-free miles.

Average Number of Hours Flown Per Month: 150.

AIR ASSOCIATES *operates eight aircraft in its business. J. E. Ashman, President (right) and Salesman Irving Ackerman are shown beside Aero Commander at Teterboro*

Name of Organization: **Air Associates, Inc.**

Address: 60 Industrial Avenue, Teterboro, N. J.

President: J. E. Ashman

NBAA Representative and Chief Pilot: Irving R. Ackerman

Nature of Business: Air Associates, maintains three divisions—Aircraft Products, Electronic Equipment and Aviation Supplies. The latter has six branch sales offices and warehouses throughout the country for service to business-aircraft operators, manufacturers, airlines, and airport service operators.

Aircraft Operated: One *Aero Commander*, five Cessnas, two Piper *Tri-Pacers.*

Most Flights Made to: Flying salesmen cover all parts of the U.S.

Average Number of Hours Flown Per Month: 65 hrs per aircraft.

ing in order to do one or two days of productive work. He has learned that he can use the airplane and double, often quadruple, his productivity. He can step up his efficiency by taking to the air. Surface transportation lacks the speed, the directness and the convenience to meet this modern business pace.

"The necessity for business aircraft as a business tool to be used as a supplement to the services of airlines is easily understood. There are approximately 6,000 airports in the United States and only about 600, 10% of them, are served by airlines. American business is on the wing; its decentralized operations and the pace of business competition require air travel. If airlines cannot serve the whole need of the businessman, and it has been found economically unfeasible for them to do so, then business airplanes are a 'must.'"

The very fact that in 1954 business aircraft flew some 3,900,000 hours and 546,000,000 plane-miles compared to the 3,200,000 hours and 518,000,000 plane-miles of the domestic scheduled air carriers, is proof enough that business flying is booming. It promises to exceed this in 1955.

New NBAA Members

Aircraft Radio Corporation
Boonton, N. J.
NBAA Rep: H. S. Christensen
Company operates: *Bonanza, Navion*

Delta-C&S Air Lines
Atlanta, Ga.
NBAA Rep: Erle Cocke, Jr., Vice President.
Chief Pilot: T. P. Ball

Delta Drilling Company
Tyler, Texas
NBAA Rep: G. P. Rider, Chief Pilot
Company operates: Beech D18S

Federated Department Stores, Inc.
Cincinnati 2, Ohio
NBAA Rep: Herbert Landsman, Research Dir.
Chief Pilot: R. O. Gragg
Company operates: Douglas DC-3

General Aircraft Supply Corp.
Detroit 13, Mich.
NBAA Rep: Lawrence F. Zygmunt, Pres.
Chief Pilot: John S. Hammond
Company operates: 2 *Tri-Pacer* PA-22's

Gopher Aviation, Inc.
Rochester, Minn.
NBAA Rep: A. G. Hoffman, Pres.

Landis Tool Company
Waynesboro, Pa.
NBAA Rep: Lee Balestra, Chief Pilot
Company operates: Lockheed *Lodestar*

Oakland Airmotive Co.
Oakland, Calif.
NBAA Rep: E. H. Gough, Pres.
Company operates: Cessna 140

Pacific Aircraft Sales Co.
Oakland 14, Calif.
NBAA Rep: Ivar Akselsen, owner
Chief Pilot: Ivor Witney

Youngstown Airways, Inc.
Youngstown, Ohio
NBAA Rep: Forest Beckett, Pres.
Chief Pilot: John Carroll
Company operates: 3 *Twin Bonanza* C-50's, 4 *Twin Bonanza* B-50's, 2 Twin Beech D18S', 2 *Bonanza* C-35's, 6 *Bonanza* D-35's and 1 *Bonanza* E-35

hielded Room Urged or Aircraft Radio Work

Better aircraft maintenance results om use of an electrically shielded om, report radio engineers of the AA.

The shielding keeps out radio in- ference which makes electrical easurements difficult and prevents curate frequency adjustments. The ielding also prevents undesirable ra- ation from going outside the room.

Radio repair shops can shield a om inexpensively by using grounded re screening or filtering any power es which enter the rooms.

A further aspect of the problem lies the crippling qualities of unin- nded and unguarded broadcasts metimes made by maintenance per- nnel testing and adjusting aircraft dios at terminal airports. Radio con- ol of either ground or air traffic often inds to a halt while some radio echanic blows, whistles or just con- rsationally reviews his previous ght's conquests. Employment of ielded radio shops as well as the quired dummy antennas will go a ng way towards amicable relations tween maintenance and pilots.

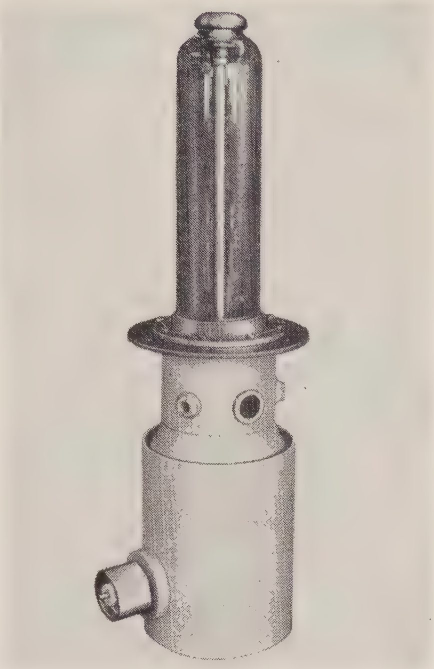
Information on construction of a ielded room is contained in Aviation fety Release No. 391. It is available om the Office of Aviation Informa- n, CAA, Washington 25, D. C.

ear Introduces New ircraft Loudspeaker

Many modern aircraft in civil cate- ries have cockpit loud speakers ilt into their communications equip- ent to relieve crews of the often un- easant headset requirement. Old uipment requires re-designing of plifiers, etc., and hence many crews not enjoy this advantage.

The LearCal Division at Santa onica has announced its Model 50, an amplifying loudspeaker that mbines, in one small case, a printed cuit transistor amplifier (2 watts wer output) and a high-quality eaker. The pilot now can plug in his eaker à la headphones style.

The speaker is powered directly om the airplane's electrical system 2- or 24-volt DC), and does not re- ire a separate power supply. The eaker is provided with a hook for rtable installation and a cord with standard headphone jack plug.



AIRTRON lightning arrester

New Lightning Arrester Safeguards Aircraft Radio

One of the ever-present fears of flight through severe storm conditions, possibly second only to extreme turbulence, is the loss of radio communication and navigation due to lightning strike. Often suspected as a contributory cause to many accidents in the past, the loss of effective radio and sometimes other damage to a storm-tossed aircraft is unacceptably expensive and a cause for emergency termination of flight.

The Airtron Co. of Linden, N. J., designer of microwave equipment, has come up with a new lightweight, effective lightning arrester for protection of costly communications and navigation gear. Designed for maximum transmission of rf energy in the 2-24 mc band, it will divert up to six lightning impulses that otherwise might be absorbed by internal radio gear, as well as eliminating the possibility of injury to operating personnel.

The arrester comprises a hermetically sealed stainless steel case to which is attached a pyrex glass standoff insulator. A capacitator within the unit in series with the rf transmission line presents a very high transient impedance to the lightning pulse, which instead arcs across three adjustable spark gaps located around an aluminum rod in the center of the pyrex glass cap.

The condition of the spark gaps is easily inspected through a conveniently located observation window. When necessary, the spark gaps and other components may be easily replaced and the unit re-sealed for further use. The capacitator is designed for minimum attenuation of the desired rf signal, and a shunt resistor by-passes any static charge that may build up on the fin-cap antenna during flight.

The unit will not flash or indicate corona up to 10 kv within its 2-24 mc band and meets all military specifications for conditions that might be encountered in flight world-wide. Weight is 6½ lbs and connections are made through modified UG-154/U coaxial connectors. Mounted within the shell of the aircraft, the arrester causes no increase in drag. Further info and spec's are available from Dept. A, Airtron, Inc., 1103 W. Elizabeth Ave., Linden, N. J.

Volscan Challenges Terminal Traffic Snarls

First made public in December 1953, VOLSCAN, the revolutionary air traffic control system, will be produced and installed at three military air bases in the United States, it was revealed recently by ARDC.

Although VOLSCAN does not replace either GCA or ILS, it does exercise long-range control over incoming aircraft, directing them until they have reached the point of final approach to the runway where these systems come into play.

Civil aviation will watch with utmost interest this first full service test of the system designed to solve the very problem which has been the greatest cause of the prodigious traffic congestion and impossible delays that attend every real IFR weather session in hi-density terminal areas.

For some time now, civil aviation air traffic and approach control procedures and navigation aids have been increasing their rate of acceptance of traffic to the point where the "cork" in the bottle has ceased to be the landing runway or the approach control system but the problem of safely keeping the top of the "hopper" filled with sufficient traffic. Holding "stacks," both over and on the enroute approach airways to these hi-density areas, are still congested with aircraft

that must be positioned individually by both pilot and controller skill so they can safely come off the bottom lined up for a successful approach. Separation standards now applicable as a result of the combination of ILS and radar on final approach, are not nearly matched by the separation standards required by enroute traffic to, and holding in, the holding "stacks."

"Flow control" (the calculation and allotting of enroute airspace to aircraft desiring entrance to a hi-density area on instruments) has served to eliminate much unnecessary delay time aloft by enforcing its acceptance on the ground at distantly located points of departure or at enforced enroute stops somewhat out of the area concerned. More often than not, like a bad-tasting medicine, it inspires drastic elimination of trouble by encouraging cancellation of many flights.

Radar inbound (center and approach) control feeding of terminal stacks has done wonders and is being extended to other bad areas as equipment becomes available. It is still penalized, however, by dependence upon the utmost in controller and pilot skill to keep track of and safely vector the myriads of targets in such a hi-density area criss-crossing each other without effective means of retaining individual identification.

VOLSCAN is a combination of radar, computer and "tracking-while-scanning" devices and has been put through thousands of tests before being accepted for production. It can feed the approach patterns of several airports at the same time, and is almost entirely automatic. Developed over the past five years by scientists of ARDC'S Air Force Cambridge Research Center, VOLSCAN can guide aircraft into the final approach to a base at precise intervals of 30 seconds. This compares with the current basic radar minima of three miles separation which, at average approach speeds, approximates well over one minute apart on final. Between aircraft capable of maintaining a reasonably matched approach speed, VOLSCAN would slice in half or thirds the best minimum approach intervals achieved today. It would virtually eliminate the problem of "stacking" over hi-density terminals for reasons other than below-limits weather.

The facts of life or at least of civil aviation remind us that inasmuch as segregation of aircraft types is apparently undemocratic and impracticable, we can never hope to deal only with aircraft types capable of maintaining similar instrument approach speeds. The greatest value of VOLSCAN to civil aviation in the immediate future,

Air-Aids Spotlight

AKRON-CANTON, O. — *ILS back course approach cancelled. TALLMADGE fan marker on NE course LFRange decomissioned.*

BATON ROUGE, La.—*Altitude over VOR on final raised to 900′, landing minimums to 800′, pullout straight ahead to 1400′.*

BROOKVILLE, Pa.—*New FITZGERALD VORW on 117.0 mc "FTZ," 14 s mi N.*

BROWNSVILLE, Tex.—*Altitude over LFR lowered to 600′ and straight-in from Los Frenos FM on final.*

BURBANK, Calif.—*Pilots interested in Glide Path lighting controversy, check new installation Runway 7.*

COVINGTON, Ky.—*BVOR now on 115.4 mc.*

DALLAS, Tex.—*ILS altitudes over LOM now 1917′, over LMM 775′.*

ELKO, Nev.—*New VORW on 116.2 eliminates dogleg on V-6, V-32 SAN FRANCISCO to SALT LAKE CITY.*

GULFPORT, Miss.—*LFRange approach cancelled.*

HOUSTON, Tex. — *VOR approach to Runway 12. Straight-in minimums reduced to 400-1 all aircraft; circling minimums 400-1, stall speed 75 mph or less; 500-1, over 75.*

LEXINGTON-LINCOLN, Neb. —*Communications station closed at LXN, commissioned at LNK.*

MEXICO CITY, Mex. — *Approach Control and Tower VHF freqs 118.3 mc, 122.5 mc, 126.18 mc and 126.9 mc.*

MONTGOMERY, Ala.—*ILS altitudes-Glide Path interception 1700′, over LOM 1700′, over LMM 430′.*

NEWPORT NEWS, Va.—*PATRICK HENRY airport ILS on 110.1, "NNW," glide path on 334.4 mc, LOM only on 375 KC, 3.13 s mi SW Rnwy 6.*

NEW YORK, N. Y.—*LAGUARDIA Ground Control may change to 121.7 mc, previously MACARTHUR Local Control as well as PHILADELPHIA Approach Control.*

ONTARIO, Cal.—*Change of ILS LMM and tower freq to 215 KC.*

PHILADELPHIA, Pa. — *ILS straight-in minimum 500-1 when glide path inoperative.*

PITTSBURGH, Pa. — *ALLEGHENY COUNTY ILS and ADF procedure turn now South of ILS course to avoid GREATER PIT traffic. Greater "PIT" ILS (and approach lights) on 110.3 serving Rnwy 32, decommissioned and relocated to Rnwy 28, replacing previous "GPB" localizer. Glide path altitude over RIVER LOM 2,950′, over PARKWAY LMM 1,380′.—GREATER PIT ILS straight-in Runway 28 minimums now 200-½; procedure turn, Glide Path interception and LOM altitude all 3000′.*

RICHMOND, Va. — *Approach Control and Tower VHF now 119.5 mc, same as RALEIGH-DURHAM. Caution!*

ROCHESTER, N. Y. — *ILS LMM changed from 215 KC to 379 KC.*

SALT LAKE CITY, Utah—*VOR approach straight-in minimums now apply to Rnwy 16R.*

SPARTANBURG, S. C.—*LFRange landing minimums now 400-1, 75-mph stall speed or less; 500-1, over 75 mph twin-engine; four-engine remains 500-1½, all are day or night minimums.*

ST. LOUIS, Mo.—*New BELLEVILLE VORW on 112.2 mc "BLV" should open V-14 bypass airway South of ST. LOUIS.*

THERMAL, Calif. — *LFRange recommissioned on 242 KC "TRM," courses 56° A, 144° N, 236° A, 324° N, on old Blue 24, DAGGETT to EL CENTRO.*

TOLEDO, Ohio—*EXPRESS Airport ILS on 109.7 mc, glide path 333.2 mc. "TLX," serving Rnwy 7. LOM "TL" on 219 KC, altitude 2,000′; LMM "LX" on 201 KC altitude 865′. Approach Control tower moved from Municipal, no change.*

VICHY, Mo.—*LFRange freq now 400 KC.*

ierefore, lies in its unquestioned abil-
y to keep the various approaches in multi-terminal area fully occupied ith aircraft. From there we may have go on to expanding the capacity ground handling facilities and gate eas, the next most critical source of elay to the flying public.

The thought of resolving the prob-m of incompatibility of jet-transport strument-approach problems with ose of piston-powered aircraft is dis-rbing the sleep of industry and gov-nment leaders alike. A delegation such from one hi-density region ea has just returned from England ith their fingernails well chewed.

What they saw of British treatment jet-transport instrument-approach oblems did little to soothe their erves as aerial traffic jams as we now them just do not exist over ere. Jets do not hold in the "stacks" we think of it. They are either eared right in for let-down and land-g or they divert to some point where ey can be cleared immediately. This not about to happen here.

The military, of course, will employ OLSCAN with a heavy percentage jet aircraft at their projected instal-tions and much may be learned to oviate the foregoing. The Crosley ivision of AVCO Manufacturing o., Cincinnati, Ohio has been varded the contract for the first ree installations to be tested.

Ben Greene, 37-year old Project ientist, received the Thurman H. ane Award from the Institute of Aero-utical Sciences for his participation the work.

AA Publishes Approach rocedures For DME

Shorter, quicker, more direct in-rument approaches through the use DME have come a step closer to ality with circulation by CAA of w approved approach procedures to heyenne and Salt Lake City airports ing DME as an aid to navigation.

The forerunner of approved ap-oach procedures using DME to ex-edite traffic movement at many air-orts throughout the United States, e new procedures take advantage of e pilot's constant knowledge of his act distance from the VOR/DME ILS/DME station and permit him let down via more direct routing.

Final approach procedures take ad-ntage of orbiting at a constant ra-us of predetermined distance which ill bring the pilot accurately to the nal approach to the runway.

The ability to orbit—that is, flying an arc a constant distance from e station—has been found extremely mple for the average pilot to execute.

Beechcraft Super 18

(*Continued from page 8*)

like the power-off stall, there is very little buffeting and mushiness in the controls to pop the pilot awake. However, the Atlantic Aviation "Super 18" I flew was equipped with a shaker stick and the Flight Safety warning indicator was triggered about 6 mph in advance of the stall. That combination should provide ample warning and ample recovery time for any pilot with his mind on his business.

Not the least of the reasons for the marked increase in performance of the E18S is the P&W R-985-AN-14B engine with its rating of 450 hp for both take-off and continuous power. It is a nine-cylinder radial with single-speed, single-stage integral blowers and direct propeller drives. The pair of R-985's on the "Super 18" are fitted with NACA cowling and pressure-type baffles, and cooling can be controlled by opening and closing gill-type flaps on the lower trailing edges of the cowls. Hamilton Standard Hydromatic two-blade, full-feathering propellers with constant-speed governors are used on the P&W engines.

The engines are equipped with jet-type exhaust stacks which add thrust without cost in extra fuel. The addition of two feet to the total wing span, plus droop-type wing tips, increases both single-engine rate of climb and ceiling at the higher gross weight. The new Hamilton Standard propeller blades also help to increase rate of climb and single-engine ceiling, as well as to contribute to the higher cruising speed.

The new conical nose section has enabled Beech to install radio equipment forward, leaving the rear fuselage free for baggage. There also is room in the nose section for an additional 80-gallon auxiliary fuel tank which can be used for either or both engines. In the center section between the wing spars is a 76-gallon fuel tank and a 25-gallon auxiliary tank for each engine.

Landing characteristics of the aircraft are improved, I believe, by installation of a higher tail wheel and the addition of elevator down springs. The tailwheel, which is set 6 inches higher than on the standard Model 18 Beechcraft, is fully retractable.

There are many other improvements over the D18S, each contributing to comfort, performance, and ease of maintenance or to operating efficiency, but those listed here are the major changes.

The price tag on the standard model E18S Beechcraft powered by military surplus P&W R-985 engines and equipped with Hydromatic propellers is $98,975.

Optional equipment includes: Goodrich inflatable de-icer boots, propeller anti-icing equipment, windshield wiper installation, airline-type clearance lights, complete custom exterior paint, super soundproofing with double cabin windows, Hardman-type cabin chair, cabin table, Thermos bottle installation and cup dispenser, refreshment bar, nose taxi light, flares, Grimes rotating navigation light, 100-amp generators, Sperry C-4-A Gyrosyn compass, extra batteries, and engine pre-heat system.

Beech is offering a choice of three radio installations. Installation "A," which weighs 159 lbs, includes a Lear ADF-R14 with loop and remote tuning control, Lear LVTR-36 for VHF communications, ARC 15D navigation (Omni) receiver with tunable 108-135 mcs receiver, ARC R-11B standby transmitter, ARC R-11A range receiver, Flite-Tronics MB-3 with three-light indicator and aural signals, Collins 51V-2 glide slope receiver and 37P flush-mounted antenna. An additional ARC 15D Omni may be added at a weight increase of 24 pounds. The ADF-R14 can be exchanged for an ARN-7 new surplus ADF at additional cost and a weight increase of 62 lbs.

Radio installation "B" includes the ARN-7 ADF, which may be exchanged for the Lear ADF-R14 at a saving of 62 lbs and $135, Wilcox 440 transceiver for VHF communications, ARC-15D navigation receiver, ARC T-11B standby VHF transmitter and ARC R-11A range receiver, Flite-Tronic MB-3, and a Wilcox 429 glide slope receiver with Collins 37P antenna. An additional ARC 15D also is available.

Installation "C," priced at $17,615, has the same ADF, standby transmitter, range receiver and marker beacon receiver as configuration "B" but utilizes the Collins 17L3 transmitter and the Collins 51R3 VHF and Omni receiver, Collins 51V-2 glide slope receiver, and the Collins 51R3 navigation receiver. A Lear ADF-R14 may be exchanged for the ARN-7 new surplus ADF at a saving of 62 lbs and $135.

Beech also is offering executive operators a choice of two deluxe instrument panel arrangements. Panel No. 1 complies with the recommended SAE configuration, and Panel No. 2 is an alternate arrangement. Both arrangements include, in addition to standard instruments, the following items: airspeed indicator with separate heated pitot system, vacuum-driven directional gyro and artificial horizon, altimeter, rate-of-climb indicator and an electrically operated turn-and-bank indicator. Grimes "eyebrow" lights for indirect lighting of individual instruments also can be installed.

Summing up, I can report that the "Super 18" Beechcraft offers the business-aircraft operator reliability, ruggedness, comfort, a favorable combination of speed and operating economy, and a non-stop range that is competitive with the intermediate airliner making one or two stops.

BEECHCRAFT "SUPER 18"

Performance at Gross Weight:

Maximum Speed (5,000 ft)	*234 mph*
Rate of Climb (2-eng, S.L.)	*1,350 fpm*
Rate of Climb (1-eng, S.L.)	*320 fpm*
Service Ceiling (2-eng)	*23,300 f*
Service Ceiling (1-eng)	*8700 f*
Extreme Range w/45 min. reserve @ 215 mph @ 10,000 ft	*1,120 m*
Extreme Range w/45 min. reserve @ 182 mph @ 10,000 ft	*1,455 m*

Cruising Speeds:

200 hp @ 5,000 ft	*175 mp*
200 hp @ 10,000 ft	*182 mp*
260 hp @ 5,000 ft	*196 mp*
260 hp @ 10,000 ft	*205 mp*
300 hp @ 5,000 ft	*207 mp*
300 hp @ 10,000 ft	*215 mp*

Specifications:

Allowable Gross Weight	*9300 lb*
Empty Weight	*6,150 lb*
Useful Load (fuel, oil, pilot, payload)	*3,150 lb*
Wing Loading	*25.75 lbs/sq*
Power Loading	*10.32 lbs/h*
Powerplants	*2 Pratt & Whitne R985-AN-14*
Meto & Take-off Power	*450 hp @ 2300 rp*

Skyways Round Table

(*Continued from page* 19)

affc away. With high-speed aircraft at),000 to 29,000 ft we are today allowing vice the area. We know that it's almost npossible for a high-speed jet to stay in ie air at 180 mph TAS, so above 29,000 we are allowing three times that area r holding. Those are some of the places here we feel DME can expedite air traffic . the holding field and, perhaps, reduce ie size of the area."

ystem Acceptance

H. Lamb, Jr.: "From the user's stand- oint, what is the life expectancy of VOR id DME? Perhaps we can settle this ACAN controversy. Is there any definite nderstanding whether civil aviation will e able to use VOR indefinitely?"

avid Thomas: *"As you know, both OR and DME are an approved part of the ommon System which has been adopted all interests in the U.S. concerned with ilitary or civil aviation. The time schedule RTCA's SC-31 indicated that by 1962 OR and DME would be obsolete and we ould go on to some Ultimate System hich has not yet been defined. We are hind the time schedule on DME because was presumed to have been in full oper- ional use by 1952. Here it is 1955 and 's just coming into use. The possibility of me other system is controversial and also assified. However, I'll go along with the atement made by Don Stuart at the NBAA eeting in Dallas. He said, 'Buy it and use . . . VOR-DME is here today . . . it has e accuracies required . . . it is available . . it has been implemented.'*

"Any other system is not yet available id it's my own guess that you will wear it the DME before we get into some ltimate System which may be a replace- ent."

. I. Rice: "Wouldn't it be safe to say at it would take from 10 to 12 years to nplement any new system even if it were greed upon at this time?"

avid Thomas: *"That has been the CAA's perience. As a matter of fact, the LF/MF anges are going out of operation now, it Mr. Stuart is still making new modifi- ations and developments on them even as e are withdrawing them from service."*

il Quinby: "It is significant to note that RTCA's SC-31 time schedule DME was be carried over into an Ultimate System id not obsoleted at the same time VOR as. That is long-range thinking on the irt of SC-31 and it still looks pretty good most people in the business. We have en through this implementation program VOR, ILS, GCA and DME, and we now by now the time it takes to develop i idea into a practical navigation system nplemented with the necessary ground id airborne equipment available to all the rspace users. That life cycle of the de- elopment of any system seems to me to efine a very useful life for an existing juipment."

avid Thomas: *"That has been borne out our experiences with all navigational vices."*

ob Froman: "There are some funda-

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Skyways Round Table

(*Continued from page 29*)

mentals important in the introduction and consideration of any new equipment, and if we can get across a point or two here I believe we will be doing the aviation business more good than any single thing I know of.

"As I understand it, we are here to discuss 'Where is the missing DME and why isn't it clipping off the miles in the aircraft?' To me, there are two basic reasons: (1) technological acceptance by the military services, the scheduled air carriers and general aviation; (2) user acceptance by the military services, the scheduled air carriers and general aviation. We must have those two fundamental things if we are ever going to introduce and get acceptance of new equipment.

"In regard to Reason 1, there has been a question as to whether or not DME would meet military tactical requirements. As for Reason 2, I personally feel there has been a question in the minds of technical personnel of the scheduled air carriers as to whether the DME *vs* TACAN question is valid. Therefore, the tendency has been to wait and see. This should be resolved in the near future, thanks to constructive action taken by ANDB. There also appears to be a question in the minds of certain people as to how much DME will contribute to the air navigation and control problem. The CAA has taken the necessary action to dispel that. Personally, I don't feel that the controversial DME-TACAN picture is as bad as some feel it to be. We are going through the normal cycle associated with any new piece of navigational equipment and that cycle follows a definite pattern: development, design, test, technological acceptance and, finally, ground implementation. We went through it with the four-course range, ILS, GCA and VOR.

"The important factors to be kept in mind when considering air navigation or air control problems in relation to specific equipment, lie in the following categories: (1) operational requirements, both current and long-range; (2) continuous research and development; (3) a realistic cycle of research and development tests, user acceptance and implementation; (4) realistic time-scheduling of equipment toward the final objective—expeditious and safe movement of air traffic."

Airline Appraisal of DME/Radar

David Thomas: *"Mohawk Airlines has had considerable experience with the earlier developments of DME. Mr. Taylor, what are your observations?"*

R. R. Taylor (*Supt. Communications, Mohawk Airlines*): "We have had dual Omni since 1948, but it has only been within the last two or three years that we have begun to realize on our initial investment in the Omni equipment. And from this fact stems our interest in DME. As you probably know, we have an ANDB-sponsored program at the present moment and have 10 DME units installed in our fleet of 10 DC-3's. We have run many tests and have taken over 4,000 recorded readings on the DME units. Concerning the operational phases of DME, we definitely believe there is a dollar-for-dollar value to us that will warrant installation of DME in our aircraft. However, we do need more operational experience."

David Thomas: *"Mr. Timmerman, what are your views on the use of DME as far as the scheduled air carriers are concerned?"*

Craig F. Timmerman (*Dir., Air Navigation & Traffic Control Div., ATA*): "The use of distance-measuring information by the scheduled airlines has been something of a controversial subject, inasmuch as the airlines thus far have not seen fit to make the expenditures necessary to equip their fleets with units that will do this job. In analyzing distance-measuring capabilities and its contribution to the over-all picture, the problem resolves itself into two phases: navigation and traffic control.

"In the navigation area, there is indication that distance-measuring information can contribute considerably to better operation of aircraft. This possibility, however, must be tailored to the particular operation of a particular user. One user may find advantages, another user would not. Specifically, lower enroute minimums might be a material contribution to some; to others it might be insignificant. In connection with high-performance aircraft, perhaps range information would contribute considerably to the economical operation of these aircraft.

"Each of these, however, is an individual application and subject to study over the particular terrain, routes, etc., that the specific operator is confronted with.

"Fortunately, in this area of navigation a decision to use DME can be an individual determination. It isn't necessary that all aircraft be equipped to benefit from this particular phase. It doesn't require a program with a high percentage of airspace users participating. Despite these contributions, there are other aspects that detract to some extent from the use of DME. One is the use of radar, both in the enroute and terminal areas. Radar will do many things DME can do, plus a lot more. The area of traffic control is where the airlines must make a decision in unison with other airspace users in order to enjoy the benefits.

"We were enthusiastic about range information when SC-31 was doing its work. A great deal of this enthusiasm, however, was aligned with the possibility of the development of a satisfactory course-line computer. If developed, this device would be very helpful because of the laterai separation problem that has dogged traffic control for so long and which has never been satisfactorily resolved. Unfortunately, the course-line computer has not reached the usable stage. It is not in use and we don't believe it gives any promise of being in use in the near future.

"Without the advantage of course-line information, we can't find justification for making the expenditures that would be necessary to equip the airline fleets. We think there are other contributions to the Common System that are more important at this time. The use of radar, for example, is important and radar beacons will have to be put into aircraft. This is an important step in the traffic control system and it is an expenditure we are going to be called upon to make at an early date. The information you can get from a beacon,

ıaking radar information more reliable nd more extensive, will give the traffic ontroller the same type of information hat accurate range data would give, and t will do it much better because it will e given to him direct, whereas the range ıformation in the aircraft must be passed n to the controller by the pilot and the ontroller in turn has to post it so that he information can be correlated with imilar information from other aircraft. 'his would involve an undue amount of ommunications.

"It is true that DME is one way of getng range information. However, there are ıany others. Distance measuring on the AA program has been aligned with VOR avigational aids. The VOR navigational ids in themselves give us a multiplicity f fixes in high-density areas. I sometimes ıink, however, that too much credence is iven to the possibility of having multiplex information. From a traffic control andpoint, the controllers can only asmilate a certain amount of position data here there is a minimum requirement. eyond that minimum requirement, the ata is harmful to the traffic control people nd to the men in the cockpit. One of the creams we hear from pilots and those in ıe traffic control system is the high numer of reporting points that must be iven because of the complexity of the proedures that keep aircraft at safe distances nd get them to their destinations.

"The success of any traffic control sysm, regardless of any devices that I know f or that may be developed, is contingent pon good communications. Communicaons should be speedy and accurate, but ot over-burdening. The interchange of o much range as well as azimuth forıation will do more harm than good to ıe traffic control system.

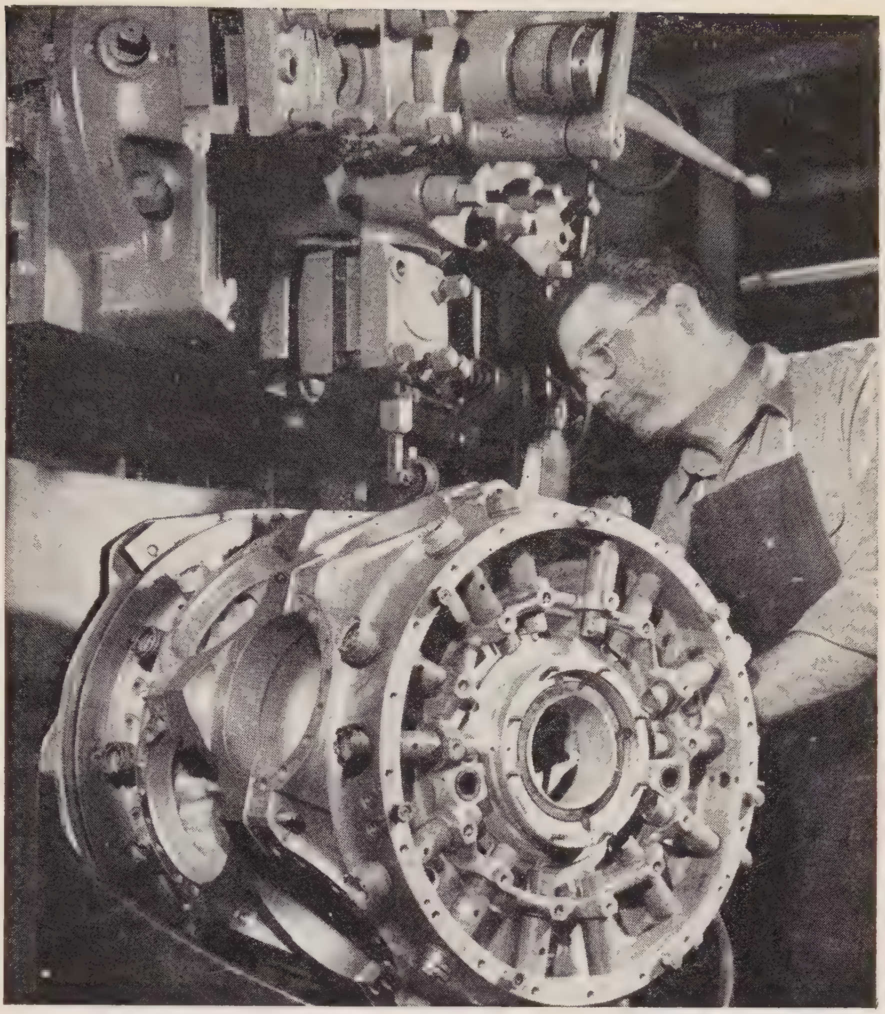
"Therefore, from a traffic control standoint, we do not feel that the contribuons which DME would make over and bove that which we can get from other ources are substantial and would not jusfy the large expenditure of funds necesıry to equip the airline fleets."

avid Thomas: *"Mr. Timmerman menoned the course-line computer and the ıpending implementation of radar beacıs in the airplane. Mr. Stuart probably ıs had more experience with the coursene computer than anyone else here. Don, ould you tell us of your experience with e development of the course-line comıter?"*

on Stuart: "I was surprised to hear raig say that this computer development asn't kept pace with DME because we el that it has. We have used several fferent models of both the course-line mputer and the pictorial computer with ry satisfactory results.

"On our ATC Simulator at Indianapolis, e ran a series of tests to determine the lue of the pictorial computer, particurly in handling terminal area traffic. A ıblished report showed that it would be ı outstanding success in this field and ould enable us to handle all mixtures of affic from the fastest to the slowest airaft without significant delay. I'm surised that anyone feels that computer velopment hasn't kept pace with DME.

(Continued on page 32)



Skyways Round Table

(*Continued from page* 31)

"Craig also mentioned an earlier enthusiasm for DME which has since waned. It is true that there was an early enthusiasm for it on everybody's part, for the whole system in fact, and a program was agreed upon by all concerned. Acting in good faith with those who formulated the program, the CAA went ahead and spent millions of dollars of taxpayers' money to implement this system of VOR-DME on the airways. The idea was that it was something all users of the airways would want because all of them had participated in formulating the program.

"Insofar as DME's use in traffic control is concerned, we must recognize that the present system of traffic control is going to need a thorough revision within the next several years. The methods we now are using are inadequate under certain conditions. I don't believe the problem of too many reporting points will be of much importance. I can conceive of a system using DME that actually would reduce the interchange of information between pilot and controller because the pilot would know where he was at all times. That information would be available to the controller on request and to the crews of other aircraft. It would provide a much more flexible arrangement than the present system of reporting over established fixes."

Bob Froman: "Quite a few members of the original SC-31 group are here and we also have a great deal of pilot experience around this table. Therefore, I'd like to pose a question regarding navigation. What else does a pilot really want to know to navigate, besides his bearing from a known point and his distance from that point so that he can determine his exact position and make the necessary reports to ATC?"

Capt. Scribner: "He is primarily interested in his ground speed and that is one of the problems we have today. You get a bearing or a fix and then after a period of time you get another bearing or fix and in that way determine your ground speed. To me, one of the most interesting things mentioned here today is the possibility of our getting an automatic device in an airplane that would give us an immediate indication of ground speed."

Ernie Burton: "There probably is a difference in needs between business and airline pilots. By the nature of their operation, business pilots fly all over the United States and not with any regularity on any one route as the scheduled airline pilots do. The airline pilot knows his courses automatically and all the procedures along that route. Therefore, the airline pilot's need for that information is less than it would be for the business or private pilot. Perhaps that fact explains the difference in acceptance of the DME.

"At the NBAA meeting in Dallas I was surprised to learn that over 100 business aircraft are already equipped with DME, as opposed to less than 10 airline aircraft. That's aside from Mohawk's fleet. It is significant that DME makes flight easi and safer and, as one pilot expressed i 'it arranges for a tranquility of spirit That's one thing we pilots are trying t get—'a tranquility of spirit.' "

Gil Quinby: "One of the problems in a traffic control involves the ground co troller. He has more work to do than h can handle and that stacks things u Radar definitely is desirable on the groun but good continuous position informatio to complement the ground controller's rada picture is equally desirable in the air traffic is going to proceed smoothly."

David Thomas: *"The CAA recognizes th traffic control problem and is working wit industry and other governmental agenci for a solution. But traffic control is only good as and no better than the communica tions and navigation system on which it based. Traffic control is as precise as nav gation is precise; it is as rapid as com munications are rapid. Therefore, an improvement in navigation and communica tions will help. Procedures are not difficu to develop if there is a good base to sprin from."*

W. H. Wilson: "I'd like to point ou that the development of DME and pric to that the development of the beaco concept were undertaken because rada fundamentally was not a navigational d vice. I would, therefore, question ho and to what extent Mr. Timmerman visu alizes the use of radar as a prime naviga tional aid. The use of radar for stor evasion is very sound, but when you dev ate from your course to go around a stor how are you going to navigate? It woul seem to me that DME would be essenti and a closely integrated complementar item to the use of radar in airplanes.

"In its deliberations of over a year, SC-3 concluded that the radar beacon or traff control beacon was very necessary, ve usable and very desirable for installatio in aircraft. But it was to be complementar to other navigation and communicatio equipment. I'd like to point out that th particular beacon that is being planne does not operate directly in conjunctio with ground radar. You have to insta separate and special interrogating equi ment on the ground.

"The normal process would be for CA to write specifications for such equipme request appropriations, contract for som body to make it and eventually install in the key areas. Experience indicates th would take a number of years.

"The scheduled airline people are goi ahead on the beacon and the radar pr grams, and neither program has had co plete evaluation. But the airlines are n doing anything about DME which alrea is tested. I'd like to know why the airlin don't at least make a few installations find out how they can use it. Frankly, know of no cases where competent seni pilots who have had DME experience ha thought that DME was not desirable put in an airplane."

Art Ward: "I don't feel there should any discrimination between business a airline pilots. They both go into the sa terminal areas, they go the same airwa and they work in the same traffic contr The only variation is that the busine pilot's routes are more extended.

"The pilot still is and always will be definite command of his airplane and I n't see where radar is the answer for m. It may give him immediately avail-le fixes but it will increase communica-ons in his having to find out where he and how fast he is going. DME would l him that immediately and the informa-n is equally available to traffic control."

aig Timmerman: "I had no inten-n of implying that radar would be used r navigation, except in the case of radar ctoring into final approach. Radar also uld be used to shoe-horn one aircraft st another in critical positions, but ere again not as a primary means of vigation.

"This may come as a surprise to some you, but I consider navigation a sec-dary consideration in our problem. The g problem today is traffic control. With ne minor exceptions, we have adequate vigational facilities in this country, that if we were flying half as much traffic we have today. Our problem is associ-d entirely with volume. It isn't a prob-n of getting a plane from A to B, but it a problem of getting 50 planes from A to at the same time. That's why I believe r thinking should be directed to traffic ntrol aspects."

H. Lamb, Jr.: "While radar is primar- a traffic control tool, I think the VOR-ME system is the best means of monitor-g that control in the airplane and to pply that 'tranquility of spirit' Mr. Bur-n mentioned."

b Froman: "It might be well here to umerate some of the DME factors which ve been carefully weighed. Number 1, believe we agreed that DME would save ne in approach to airports not served h other precision aids. Number 2, we cided it would possibly lower enroute nimum instrument altitudes . . ."

aig Timmerman: "I'd like to inter-t here that while we agreed these are y real advantages it is all a matter of plication to the particular user as to at extent he benefits from them."

b Froman: "To go on with my list, I ieve we decided that being able to it in lieu of holding a fix would be asset in both expediting traffic and air ffic control. Another consideration favor- DME was in improved enroute navi-ion and estimating time for a fix and n making good that estimate. That uld be beneficial to both navigation and traffic control. There are several other tors which have created enthusiasm for DME principle, but those are probably primary ones."

mmary

vid Thomas: *"Before I begin summar-ng our discussion, may I take this op-tunity to thank SKYWAYS for giving this chance to bring the facts of DME the public.*

"We have brought out here that the ME ground system is well on its way to ng complete and will be so by next r at the latest. The available equip-nts are accurate and ready to go insofar further developments are concerned.

"The CAA has begun to develop new cedures and more will follow as we gain experience with DME.

"It has been pointed out that the accuracy of DME offers many improvements in navigation and many possibilities in air traffic control.

"All in all, DME has been considered here to be a very useful device by all except the airlines. The scheduled air carriers, however, do not quarrel with DME's navigational benefits. Rather, they consider the real question of its utility to be in the field of traffic control, in view of the advantages of radar. Others here feel DME will make significant contributions to air traffic control.

"Mr. Quinby's remarks that DME is an extremely useful device for day VFR flying were most enlightening, and I know it would definitely add to my tranquility of spirit on a smoky day on the East Coast.

"The question of computers came up and I believe we should follow more closely the development of procedures for the actual use of computers.

"Government agencies, particularly the CAA and CAB, will watch DME's development and stand by ready to assist by promulgating whatever regulations are indicated, by implementing those regulations and by developing procedures for DME's use.

"Thank you, gentlemen, for taking part and for aiding SKYWAYS in making your knowledge and experience available to the aviation public."

High Speed Flight

(*Continued from page* 12)

other source of wing-drop problem to the supersonic plane. This source is the bow wave on the nose of the plane. The airplane nose bow wave is shown for several Mach numbers on a plan view of a possible supersonic airplane configuration in *Fig. 4.* These fuselage bow waves bend farther aft as the Mach number increases. At some Mach number, depending on the geometry of the airplane, the bow wave will intersect the wing. If the bow wave is not perfectly symmetrical, as might be caused by the airplane flying at a small amount of yaw, the pressure and velocity changes through the shock may induce disturbances on one wing before the other. Consequently, it is possible that the bow wave or asymmetric shock waves from any other part of the airplane forward of the wing, if severe enough, may create a new wing-drop problem for the supersonic airplane.

Pitch-Up

The phenomena of pitch-up, sometimes referred to as dig-in or over-shoot, was first encountered by fighter planes of World War II. It has persisted in the aircraft built since then and undoubtedly will crop up as a serious problem in some airplanes of the future. This is a condition in which the airplane suddenly pitches up or digs in during a pull-up or turn to a load factor (G) considerably higher than the pilot intended. Several detail causes can be blamed for this condition, but all of them are the result of shock-wave formation.

One of the original causes of pitch-up was the elevator trim tab. The pilot would begin a dive during which he continued to trim with the elevator tab to keep the stick forces comfortably low. Eventually, the airplane reached a speed where normal shock waves formed on the horizontal tail. The elevator tab was then operating in a thick boundary layer behind the normal shock. The trim tab effectiveness (its ability to trim out stick force) was very low. When the pilot began his pull-out from the dive, the pull stick forces were very high, necessitating large amounts of nose-up trim (tab down) to lower the stick forces and aid the pull-out. As the airplane gradually increased load factor and pulled out of the dive, it slowed up until the speed was low enough over the tail that the shock waves were minimized or completely disappeared. This resulted in the tab effectiveness increasing back to its original high value with the result that the tab forced the elevator up causing a rapid pitch-up before the pilot could do anything about it. This probably will not give pitch-up trouble on the supersonic airplane because no one in his right mind would use a conventional elevator tab system on a supersonic airplane. And if he did, he surely would recommend that it not be used in conditions as just described.

A second cause of pitch-up is shown by the data in *Fig. 5.* This is a plot of airplane lift coefficient (C_L) *vs.* airplane pitching moment coefficient (C_m) for various Mach numbers. The curves are shown for a stabilizer angle (or elevator angle, as the case may be) of zero degrees. Curves for other stabilizer angles would be almost parallel to these zero degree curves at the corresponding Mach number. The increasing negative slope as the Mach number increases indicates a large increase in the static stability margin. This increasing negative slope is mainly the result of the wing center of pressure moving aft as the normal shock waves move aft on the wing.

As an example of how pitch-up develops, assume that the pilot is pulling "G" (increasing C_L) at 1.2 Mach number. Assume that the airplane is flying in level 1.0-G flight at 0.1 lift coefficient and the pilot pulls up to 5 G (corresponding C_L is 0.5). As the value of C_L increases the drag also would increase and the airplane would slow up, say, to M=1.0. If the stabilizer angle is held constant while the airplane slows up, we find that the pitching moment being overcome by the stabilizer is less negative at 1.0 Mach number than it was at Mach 1.2. In other words, a nose-up pitching moment is applied to the airplane due to the decrease in speed in the turn or pull-up with the result that pitch-up occurs. This has been a source of pitch-up on the transonic airplane and also will be one on the supersonic airplane in the transonic range of Mach numbers.

This condition is further aggravated by the relatively low effectiveness of the stabilizer in the transonic range. This effect can be explained in a manner similar to that for the tab. The stabilizer effectiveness is lower at Mach 1.2 than at 1.0. Consequently, if the pilot is holding a constant stabilizer angle, the increase in effectiveness when the airplane slows up will cause additional pitch-up.

Actually, pitch-up due to these latter two causes probably will not be too serious on the supersonic airplane if a good powerful control is provided, such as the movable stabilizer, so that the pilot can stop the pitch-up. It also is probable that pitch-up due to these causes will not exist to any great degree at Mach numbers above approximately 1.5 since the aerodynamic center variation above this Mach number will be comparatively small.

One other source of pitch-up is shown by the unstable (positive slope of C_L *vs.* C_m) or hook-back portion of the curves from 0.6 to 0.9 Mach numbers between 0.4 and 0.6 C_L. If the "G" is increased sufficiently to fly in this C_L range, the nose-up pitching moment increment contributes to over-shoot even at a constant Mach number. This cause of pitch-up can be minimized and in some cases eliminated (C_L *vs.* C_m curve maintained approximately linear to the maximum C_L) by proper selection of wing planform, wing leading-edge camber, wing leading-edge slats which are open in this lift range, and in some cases by proper vertical location of the horizontal tail with respect to the wing. Horizontal tail locations below the wing have been installed on some recent supersonic airplanes primarily for this reason.

Unaccelerated Stability

Fig. 6 shows a typical plot of stabilizer angle required for amounts of "G" vs. Mach number for a typical but fictitious supersonic airplane. The negative slope of the 1-G stabilizer angle curve is a measure of positive unaccelerated static stability, as are the C_L *vs* C_m data of *Fig. 5.* The region between M=0.85 to 1.1 thus exhibits instability with a change in Mach number

rough the data of *Fig. 5* shows high itive stability at a constant Mach num-
.

'rom the pilot's viewpoint, the action of airplane in the .85 to 1.1 Mach number ge would be described as tucking. As pilot increases speed in level flight, the plane would tend to dive requiring the ot to pull back on the stick. The pilot's nition of positive unaccelerated static bility would then be that as he increased ed he would have to move the stick tinually forward (stabilizer would move tinuously in a nose-up direction with reasing speed).

'his reversal of stabilizer angle with rease in speed may prove troublesome the supersonic airplane if it cruises in Mach range. For this condition the t would trim the airplane "hands off" he desired speed, say, M=0.95. If the plane encountered turbulent air which sed considerable speed change, it would tinue to wander from the trim speed.

eferring to *Fig. 6*, assume that a gust encountered which slowed the airplane n its cruise speed of 0.95 to 0.93 (inated airspeed change of 7 knots at an tude of 40,000 feet). Since the stabilizer le (or elevator angle, if one is being d) would remain fixed at its trim posi- (pilot's hands off the stick), the dese in speed would cause the airplane start a slow pull-up to 1.2 G. The inse in "G" would further slow the airie, causing it to pull-up to a higher '. Thus, the airplane would continue to der away from the trim speed requiring stant pilot attention. However, cruising use of an autopilot would be satisfactory e it would provide the constant atten- necessary to maintain the trim speed. eral flying by the pilot in this range bably would not be troublesome, alugh he would have to pay continual ntion to maintain a constant speed.

he degree of change in stabilizer angle this 0.85 to 1.1 Mach number range ends primarily on the wing planform pe and the airfoil section used. In some s it might also depend on the horial tail vertical location with respect he wing (tail undesirably enters wing e at high C_L).

nother way of explaining pitch-up due hanges in stability (increasing negative e of C_L *vs* C_m curve) as a function of h number also is shown in *Fig. 6.* ume that the pilot intends to pull 3 G Mach number of 1.0. For the airplane sidered in *Fig. 6,* he pulls back on the k to change the stabilizer angle from 25° to −3°. If he can maintain the h number constant by diving or insing power, no pitch-up will occur. wever, if the speed (and hence the Mach nber) decreases appreciably, pitch-up result. For this example assume that Mach number decreases in the pullor turn to approximately M=0.95 while s holding the stabilizer angle constant. m *Fig. 6*, it is seen that for the −3° ilizer angle at a Mach number of 0.95, airplane will be at 4 G. Thus,, it has hed up an increment of 1 G from the nded 3 G. This can be a serious prob- if much pitch-up occurs since strucl limits may be exceeded. It would be e serious on bombers than on fighters ause of the relatively low limit load factors. Since this pitch-up condition probably cannot be completely eliminated, the next best thing that can be done is to provide the pilot with a longitudinal control surface of high effectiveness to stop the pitch-up once it starts. This means that an all-movable horizontal tail should be used in preference to an elevator because of its relatively higher effectiveness.

Landing Speeds

From the pilot's standpoint, one of the major evils associated with high-speed aircraft is the high landing speed. Actually, all aircraft manufacturers expend considerable effort during design to keep the stalling speed and landing speed of current aircraft reasonably low, although it may not be possible to convince the pilot of this fact. Despite the noble design efforts, the demand for higher maximum speeds has continually pushed the stalling speed higher. *Fig. 7* shows how the landing configuration stall speed (Vs_L) has increased with increasing maximum level-flight airspeeds. For this chart all types of aircraft have been used, from the Mooney *Mite* to the F-86, including trainers, transports, bombers, fighters, etc. The stall speeds are plotted for a loading condition with approximately 10 to 15% fuel remaining. Both the stall speed and maximum speed have been obtained from published nonclassified information.

The faired lower curve through the

(*Continued on page* 36)

High Speed Flight

(*Continued from page* 35)

points is debatable. However, it is the author's opinion that the curve represents a reasonable trend for the data available. The reason for the break in the curve near the maximum speed of 270 knots is not known. Possibly it is because the airplanes below this point are nearly all of the private lightplane variety and, compared to high-speed fighter-type airplanes of today and yesterday, it may be like comparing men and women . . . and that is impossible. In any event, it is not intended that these data revolutionize aerodynamic design, but rather show that a definite trend to higher stall speeds exists as the maximum airspeed increases.

From an operational standpoint, it means increased cost, and the reasons for this are many. Since the stalling speeds increase, the landing touchdown speeds also increase. The touchdown airspeed is approximately 1.2 Vs_L for most present-day high-speed airplanes. This curve also is shown in *Fig. 7* as 1.2 times the faired stalling speed curve. Theoretically, the landing distance increases as the square of the touchdown velocity. However, in actual practice the landing ground roll increases a greater amount than this because the amount of braking which can be accomplished above 100 to 110 knots is relatively small. Probably the main reason for this is that the braking systems on current airplanes do not provide adequate feel for the pilot. The low available braking combined with the lift on the wings, detracting from the weight on the wheels, causes many blown tires before the pilot learns to take it easy on the brakes at high ground speeds. Thus, operational costs due to tire and brake wear are increased.

The problem of short ground-roll distances was increased with the use of jet engines since the high drag at idling power associated with propeller-driven airplanes is not present with the jet engines.

As a result of the higher landing touchdown velocities the airport runway lengths have continually increased. This means that airport construction costs are higher. At the end of World War II the average Air Force runway was 5,000 to 6,000 feet long. Today, these runways are 7,000 to 8,000 feet long and, in some cases, 10,000 feet. The take-off run at very heavy weights is probably equally as guilty as the landing ground roll for the increase in lengths.

Many things have been used to decrease the landing ground-roll distance for high-speed aircraft. The drag chute, for example, has done a good job of decreasing landing ground roll. It is not difficult to pack and, if properly installed, it rarely fails to do the job. Reversed thrust also is common on propeller-driven transports of today and undoubtedly will be common on some high-speed jet aircraft of the future. Flaps are still being used to decrease the stall speed (and hence the touchdown velocity), but the gains are not enough to keep the ground-roll distance from increasing as the maximum airspeed increases.

Boundary layer control by blowing or sucking air over a flap is supposed to be the cure-all of the future, insofar as reducing the stalling speed is concerned. Boundary layer control has been looked forward to for years and it appears tha the years of research devoted to it ar about to pay off. However, it probably wil only lower the stalling speed curve o *Fig. 7* by about 10%. This is a sizabl gain but, in the case of the single-engin airplane, proper pilot indoctrination wil be necessary to realize the gains. It is wel known that many single-engine airplan pilots prefer to plan the landing to insur making the runway in case of engin failure. This is particularly true of th average Air Force fighter pilot, at leas those with a low level of experience. Thi is the impression I got as a result o visits to several Air Force Fighter-Inter cepter bases in the U.S., Japan and Korea

The average pilot increases his landin touchdown speed 5 knots for each of hi children. It has also been my experienc that most pilots seem to have at leas five children, thus the touchdown spee runs about 25 knots above that recom mended.

It will be the duty of the manufacture as well as the experienced Air Force per sonnel to indoctrinate the pilot as to th necessity of proper operation of these air planes during landing. If this is not done a high rate of landing accidents will result

Rates of Descent

The current trends of wing design fo the jet-propelled supersonic airplane ar to extremely low aspect ratio. The win loadings at landing are 40 to 60 lbs/sq ft which is fairly high and of the same orde of magnitude as the present-day transoni airplanes. The combination of low aspec ratio and medium-to-high wing loading also contributes to high landing speeds an subsequent long ground-roll distances du ing landing. It is this combination whic makes it extremely difficult for the pilo to perform good landings with idle powe or power off. To explain this condition *Fig. 8* was prepared, showing rates of de scent with both idle power and approac power for a typical transonic and super sonic airplane. The data are considered reasonable representation of the airplane having a wing aspect ratio of 6 for th transonic airplane, and 3 for the super sonic aircraft. A representative wing load ing for the transonic airplane would b 50 lbs/sq ft, while that for the supersoni airplane would be 60 lbs/sq ft.

During observations made of armed-serv ice operation, it was found that a pilo likes to approach at about the same rate o descent regardless of the type of airplan he is flying. An acceptable band of ap proach rates of descent is between 8 an 25 ft/sec, with an optimum value of 1 ft/sec. It also has been found that th average pilot prefers a touchdown rate o sink during normal landings of 2 or ft/sec. On most airplanes of the past o present, an approach speed of 140% o the landing configuration stalling spee (Vs_L) has been used satisfactorily. Wit this approach speed a touchdown spee velocity of about 110% to 120% of th stalling speed has proved satisfactory fo normal landings. It is desirable to have th speed for minimum rate of sink occur nea the touchdown velocity to insure goo landing flare characteristics.

Fig. 8 presents the rate of descent fo the subject airplane using both idling powe

d approach power. In both cases the ·es of descent are in excess of the 8 to ft/sec band considered acceptable by ots. The rate of descent for the super-ic airplane is considerably higher than it for the transonic airplane because of lower aspect ratio and higher wing iding. The speed for minimum rate of k on the transonic airplane occurs at)% Vs_L. In both cases power approaches uld be recommended to obtain the de-ed rates of sink.

The effect of power, as seen by com-ring approach power *(Fig. 8-b)* with ing power *(Fig. 8-a)*, is to shift the speed minimum rate of sink to a slightly her value. This is undesirable, although the particular cases shown the effect small. Even though the optimum rate of k is obtained by addition of power, one y undesirable feature still remains with supersonic airplane. This condition is licated in *Fig. 8-b* where the rate of scent increases for speeds less than the proach speed of 1.4 Vs_L. This implies t if power is held constant during the proach, the supersonic airplane will have increased rate of sink as the speed is reased in the flare. Actually, if the ding flare is performed slowly, this is ctly what will happen. To decrease the of descent during the flare would re-re good timing by the pilot to pull ficient "G" to decrease the rate of cent and also rightly judge the touch-vn point before the airplane has lost ch speed and the rate of sink begins to rease. This probably means that the ersonic airplane of low aspect ratio and h approximately 50 to 60 lbs/sq ft ding wing loading will have to make ver approaches at 150 to 160% of the lling speed. This is necessary to insure t as he loses speed he can swap this etic energy for "G" to flare the airplane still have a little margin of "G" and ed left. The speed margin remaining is essary to take care of those cases where pilot first flares 10 feet off the ground l then has to do a little stick jockeying feel for the ground.

n any event, this means many super-ic airplanes will be touching down at eds in excess of the normal speed of ut 120% of the stalling speed, and will ult in undesirably greater landing und-roll distances.

Things which can be added to the air-ne to improve the shape of the rate of cent curve by shifting the point of imum sink to a lower speed are:

1. Wing flaps;
2. Drag items such as speed brakes and an approach drag chute;
3. Large aspect ratio (this is undesir-sirable from the standpoint of high wing weight and wing flexibility or aero-elastic effects);
4. Low wing loading (this is very de-sirable but difficult to obtain and meet all the usual design require-ments);
5. Wing boundary layer control.

gine Test Bed Installation

Several engine manufacturers are cur-tly using a retractable test bed installa-mounted in the bomb bay of a B-45 ilar to that shown in *Fig. 9*. Recently, one of the manufacturers encountered a severe tail buffet on the B-45 while op-erating the afterburner of a new high-thrust jet engine. This buffet may indicate a new problem for the supersonic airplane.

The afterburner of the new engine was not operated during the initial test and no tail buffet was encountered. However, when the afterburner was operated at the same airplane speed and altitude as the previous tests, the tail buffet was so severe that the test was discontinued after a short interval. Inspection of the airplane on the ground revealed several cracks in the tail ribs, undoubtedly due to the extreme buffet.

Initially, one might suspect that the jet engine blast was hitting the tail. *Fig. 9* shows this to be impossible since the root of the tail is 11.25 feet above the jet engine center line, and the tip of the tail is 15.8 feet above it. With the elimination of this possibility, two other possible causes come to mind. The first is that the shock waves emitted from the tailpipe hit the tail and causes it to vibrate violently at its natural frequency. The second possibility is that these high-energy pressure waves combine with the normal pressure pattern over the tail to cause unsteady shock waves to form or flow separation to begin on the tail. This is possible since the tests were being conducted at Mach numbers where mild normal shock waves would just begin to appear on the tail. The pressure pulses from the jet engines may have been just enough to induce more severe shock waves with subsequent separation and buffet.

Either of these conditions are possible and might prove to be a serious problem on some supersonic configurations where portions of the airplane extend beyond the tailpipe exit. To the author's knowledge there has been very little research done along these lines. Therefore, it is con-sidered of extreme importance that some research organization investigate this.

Conclusion

I hope that this paper has focused at-tention on a few of the design and opera-tional problems of the supersonic airplane. Undoubtedly, many ways of minimizing or eliminating these problems will be found during the next 10 years. Of all the prob-lems discussed it is the author's hope that the greatest improvements be made in re-ducing the landing speed for the pilot's sake. Perhaps the much discussed vertical take-off and landing airplane is a step in the right direction for improving the land-ing conditions of the supersonic aircraft. If not this type, then perhaps it would be the flying saucer with jet exits all around the periphery which would be the answer of the future to low landing speeds and shorter ground-roll distances. In regard to these two types of aircraft, the following quotation seems to fit:

"Although it may not be considered good aerodynamic design, you can fly anything, even the kitchen stove, if you put enough power on it."

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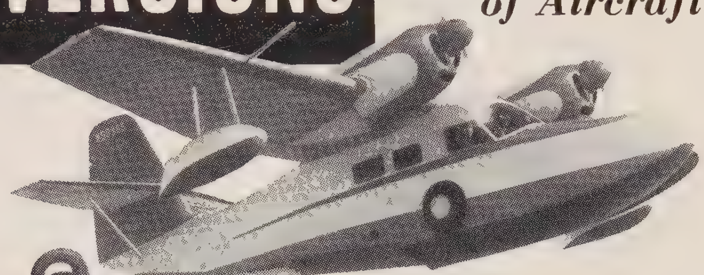

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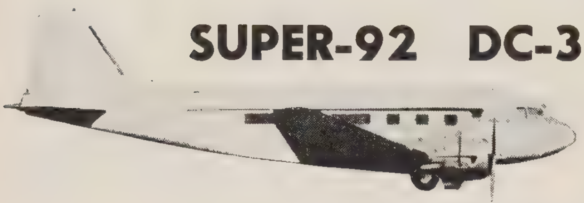

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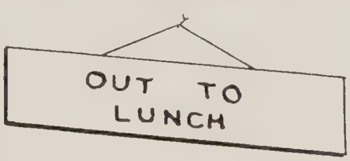

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Light Standardization

(Continued from page 15)

want centerline lights to the runway threshold for the full 3,000 ft and no over-run area. The Air Force insists on a 1,000-ft over-run area as an absolute necessity in high-speed jet operations. Pilots of these clean, fast aircraft need a lot of runway for landings and often undershoot in their attempts to use all available runway. Airline pilots call the "B" over-run area with its side bars the "black hole."

What the situation boils down to is this: Configuration "A" is completely acceptable to commercial users but not to the military. Configuration "B" is satisfactory to the military but not to commercial airlines. The result, the airlines believe, is that Configuration "B" may be implemented at all joint-use airports to the detriment of commercial operations unless strong opposition is presented.

Another point of conflict between the Air Force and the air carriers concerns military deviations from the national standards at certain airports. Pilots point out that the Air Force has installed an approach-lighting system at one airport and followed it up with a different type at another airport. This inconsistency serves to muddle still further the attempts to get all to adhere to the same standards.

Injecting configurations which are neither "A" nor "B" is directly opposed to the "interest of safety" clause in the ACC's recommendations on a national standard for approach lighting, according to the air carriers. Pilots should not be placed in the position of breaking out and seeing a different type of approach-light system at every airport, they add. The Air Force and the air carriers are currently engaged in a dispute over approach lighting at Greater Pittsburgh airport, because the military desires modifications of a centerline installation.

The accident at New York International Airport, where the slope-line system had been in use since 1949, occurred at a time when the Air Force, the Air Transport Association, the Air Line Pilots' Association, the Civil Aeronautics Administration and the major air carriers appeared to be approaching an acceptable settlement of their differences on approach lighting. The development which would hasten that settlement, they believe, is the Dutch Elfaka flush light.

Curiously, the national standard for approach lighting as established by TSO N-24 made no provision for flush lighting. The reason for that omission is that everyone who participated in the ACC sessions assumed that Configuration "A" would be installed at all airports used by civil aircraft and that Configuration "B" would be strictly for Air Force fields.

Participants in the ACC meetings, particularly the air carriers, did not anticipate the Air Force program of providing funds to the National Guard units for the operation of jet squadrons at commercial airports across the nation. It was not until the problem of approach lighting systems suitable to the needs of military and commercial operations cropped up at these

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Light Standardization

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joint-use airports that the "black hole" over-run area became such an important issue. It is only since the joint-use airport approach light controversy developed that attention has been given to flush lights as the possible solution.

Flush lights of the Elfaka type have been used for some time in Europe and the experience record with those installations was available for study by the ACC sub-committee and the CAA. Schipol Airport in the Netherlands, where American-built jet fighters are operating, is a notable example of the success attained with the Elfaka flush lights. More recently, a U. S. squadron of NATO jets was moved into Soesterberg, in the same country, and that airport also is equipped with flush lights. And flush lights are now being installed at six of Denmark's newest airports.

The CAA believes that a flush-type light may be the solution of the Air Force-air carrier controversy over the over-run areas at joint-use airports. It would eliminate the so-called "black hole" in the 1,000-ft over-run area and permit an unbroken row of approach lights over the entire 3,000-ft length to the runway threshold. At the same time, it would meet the Air Force objection to mounted lights in the over-run area. One airline captain, strongly in favor of centerline with flush lights, has suggested that the flush lights should be extended right down the center of the runway instead of only to the threshold.

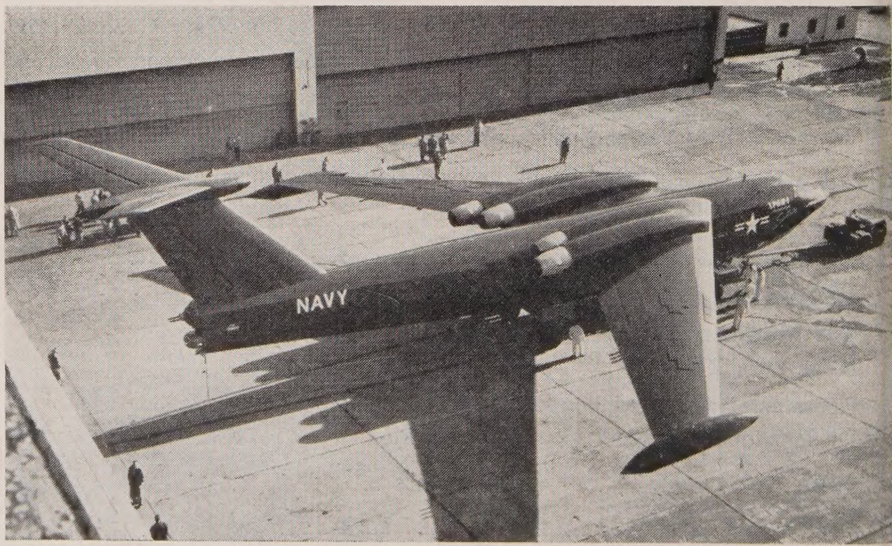
The importance of flush lights in approach visual aids systems in the United States was demonstrated by the recent decision of the Air Force, the CAA, the ATA and the air carriers to conduct an exhaustive test of the Elfaka flush light at the Knoxville, Tenn., airport, where the approach light system is configuration "B." The equipment for this evaluation will be supplied by the lighting division of Structural Concrete Products Corporation of New York, American agent and licensee for the Dutch Elfaka flush lighting system. The CAA's technical staff will supervise the Knoxville installation in cooperation with the Air Force and the ATA.

While arrangements for the Knoxville test were moving forward, the Port of New York Authority and the CAA were planning to replace the out-moded slope-line at New York International Airport with a centerline approach light system on Runway 4. As the airport operator, the Port Authority is responsible for the approach-light mountings, and mountings for a centerline row were specified. The CAA will finance and supervise the new installation. Immediately after the accident off Runway 4, the CAA raised the minimums from 200 ft and one-half mile to 300 ft and three-quarters of a mile. The higher minimums will remain in effect until the new centerline approach lights are placed in operation.

Washington National and Los Angeles Airports are now the only major air terminals using the controversial slope-line approach lights and, in view of the strong opposition to them, it appears that they may soon be slated for replacement by the national centerline system.

Still another angle in the continuing discussions of approach lighting concerns the types of lights used. The Newark Airport approach lights, identified by pilots as the best ever devised, are the sequenced flashing, or condenser discharge type lights. A short distance away is LaGuardia Airport with its side-line system, including high-intensity lights along the inner 1500 ft. There are many other combinations, some with brightness control and others without it. There is no uniformity.

Whether the condenser discharge light which has proved itself so well at Newark will become part of the new centerline system at New York International Airport had not been decided at this writing. The air carriers were compelled to underwrite the cost of the Newark condenser lights and it appears almost certain that, with the ALPA pressing for the same type of installation at New York International, the air lines will have to do the same thing at Idlewild.



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